



British Guiana.

DIVISIONAL REPORTS

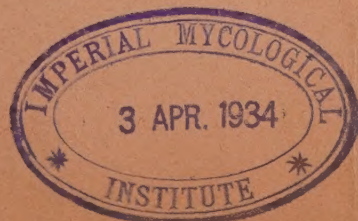
OF THE

DEPARTMENT OF AGRICULTURE,

FOR THE YEAR

1932.

GEORGETOWN, DEMERARA :
PRINTERS TO THE GOVERNMENT OF BRITISH GUIANA.
"THE ARGOSY" COMPANY, LIMITED.
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NOTE.—Each report also contains its table of contents.

FOREWORD.

In this volume the Divisional Reports of the Department of Agriculture of British Guiana for 1932 are to be found. The procedure adopted this year is similar to that in 1931 when for the first time the reports of the several Divisions were published in a separate volume. The course has been adopted since work being prosecuted in the Department has now assumed proportions that the combination of these reports, with the Administration Report in a single publication would have resulted in a volume too bulky for easy reference.

2. Since the issue of the Divisional Reports as a separate publication, numerous enquiries have been received by the Department in regard to previous issues. Attention is, therefore, drawn to the fact that after the re-organisation of the Department in 1928 progress reports of the work being conducted in the several Divisions were published as soon as the Department's official publication, "*The Agricultural Journal of British Guiana*," began to appear. Thus, the 1928 Divisional Reports were published in Vol. II, No. 4 of the Journal; the 1929 Reports were published in Volume III, No. 4; the 1930 Reports as Part II. of the *Administration Report of the Director of Agriculture* for that year; the 1931 Reports, it has been stated above, appeared as a separate volume.

3. The important conclusions arrived at as a result of the work undertaken have been briefly summarised in the 1932 Administration Report of the Director, but these more detailed reports give fuller accounts of the problems investigated, the methods of procedure adopted, the results obtained as well as the various other matters which fall within the scope of each Division. The Reports serve primarily for record and reference purposes; they indicate the comparatively wide range of problems (and the different methods of approach) which the Department is expected to solve.

J. SYDNEY DASH,
Director of Agriculture.



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DEPARTMENT OF AGRICULTURE.

REPORT OF THE BERBICE DIVISION FOR THE YEAR 1932.

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REPORT OF THE BERBICE DIVISION FOR THE YEAR 1932.

STAFF.

Hector Macluskie, U.D.A. (Aberdeen)—Agricultural Superintendent.
E. M. Morgan —Resident Agricultural Instructor,
Corentyne.
H. B. France —Agricultural Assistant.

GENERAL.

1. The year under review has been marked as one of record sugar crops, whilst the large area previously under rice has been well maintained.

Advances have been made in extension of cane seedling varieties and pure line seed padi, and full particulars are given under their respective heads.

Examination of rice for export was continued but a distinct falling off of quantities examined was noted as compared with 1931. This was doubtless due to the activities of the larger Georgetown firms which purchased rice from local agents for blending in Georgetown.

The opening of Springlands as a port of shipment and examination of rice for direct export should materially assist the Corentyne rice-growers in that a saving of about twenty cents per bag can be effected by direct shipment from that point.

Two sub-stations were opened during the year, one at Whim, Corentyne, on a sand reef, where demonstrations will be carried out and seed distributions will be undertaken. Similarly at Macaw, East Bank, Berbice, an area of bush was cleared and preparations made for establishing an experimental crop of oil palms. Both of these sub-stations should do much to encourage local farmers, and great interest is being evinced in the undertaking.

The collection and collation of the agricultural returns was carried out.

Agricultural education in all districts was continued and agricultural competitions for farmers were organised and these items together with Co-operative Credit and agricultural extension generally are considered under their respective heads.

CROP CONDITIONS.

Sugar.

2. The total acreage of cane under cultivation was 21,840 English acres whilst the total ~~average~~ reaped, including farmers' canes, was 20,578 English acres; yielding 63,600 tons or a yield of over 3 tons per acre. The record yield for any estate was 3.56 tons per acre.

Weather conditions were generally favourable, an exception, however, was the early commencement of the heavy rains which fell on newly cut spring crops and adversely affected the spring of ratoons.

Improvements in factories installations were carried out during the year which points well to the condition of the industry in these times.

Rice.

3. The acreage under this crop did not vary materially as a whole and the returns quote the total at 29,218 English acres, yielding 32,021 tons padi.

In the districts, however, marked changes occurred. On the Corentyne and Canje areas increases were recorded whilst decreases occurred on the West Coast, Berbice, of about 2,000 acres.

Generally speaking the crops were favourable. On the West Coast of Berbice large areas of broadcast crops were lost, however, owing to the excessive rainfall which occurred in the spring. This, too, hampered transplanting and land preparation in all areas to a considerable extent. At harvest time favourable weather conditions were enjoyed.

The quality of the rice in all districts is declared by millers to be improving. Pure seed distributions have materially assisted in this direction.

Rice mill improvements in the district are noted, particularly in the case of one complete German installation which is capable of making a higher grade rice.

The rice blending regulations which came into force during the year are doing much to improve the even quality of the rice manufactured for export.

The fall in prices has proved a deterrent to sales, and it is hoped that the opening of the rice grading centre at Springlands will prove a boon to growers by the saving which is effected in freight by direct shipment from that point as compared to handling in Georgetown.

Coconuts.

4. The coconut acreage does not show much change from previous years although some increase was noted on the West Coast of Berbice.

The low prices quoted do not give much incentive to upkeep of cultivation.

For the most part the local nuts are manufactured into oil for local consumption.

Fruits.—Provisions.

5. Small increases occurred in acreage under citrus fruits particularly in the Berbice River area. Limes, returned at 533 acres, form the greatest area under citrus fruits, these are grown almost wholly by one firm for manufacture into oil and juice.

6. The acreage under ground provisions was 3,420 acres. There is room for expansion in this latter line, if only to replace the shipments of plantains which arrive from East Demerara from time to time.

Vegetable Crops.

7. Marked interest is being taken in onions on the Corentyne Coast particularly, and efforts are being made to interest the farmers in English tomatoes. Large quantities of the latter are shipped regularly to Georgetown, but the consist entirely of the Creole varieties which are bitter in flavour, poor yielders and not acceptable in the markets.

SUGAR.

8. During the year the following experimental work was undertaken in collaboration with the Sugar Cane Agronomist. Full reports and results of this will be seen elsewhere and are being dealt with by the Agronomist.

In April a manurial trial in field Ankerville 8, Pln. Port Mourant was reaped and manures applied to the ratoons.

In April a manurial trial in field Bush Lot 47, Pln. Blairmont was reaped and in May manures were applied to the ratoons. In June a second dose of ammonia was applied to this experiment.

In April a variety trial was planted at Port Mourant, Ankerville 14 with 10 varieties of 7 replicates each.

In May a new variety trial was started at Pln. Blairmont in Haly Polder No. 7.

In June the ratoons variety trial in Resource 6, Pln. Port Mourant, was reaped, and on the same estate a variety trial was reaped in field Ankerville 6.

In September a variety trial was reaped at Pln. Blairmont, field Riverside 18.

In November field Riverside, Pln. Blairmont, variety trial was reaped and fields Tain Leeward and Windward at Pln. Port Mourant were sampled prior to inaugurating the flood fallow trials.

In December soil samples were procured from field Port Mourant No. 4, Pln. Port Mourant prior to inaugurating manurial trials with limestone and ammonia.

In addition, frequent visits were paid to estates to see and note progress of nurseries, etc.

9. The following is a summary of the acreage under different seedlings in the district. For the purpose of the summary no seedling which showed a total acreage of less than 5 has been included. A separate report giving complete details reveals the full position, for each estate.

Diamond	10	...	...	299 acres
D.	663	...	...	120 "
D.	814	...	...	69 $\frac{1}{2}$ "
D.	666	...	...	37 $\frac{1}{2}$ "
D.	367	...	...	11 "
D.	835	...	...	31 $\frac{1}{2}$ "
D.	671	...	...	5 "
P.O.J.	2878	...	...	41 "
D.	695	...	...	6 "
S.C.	12.4	...	...	52 $\frac{1}{2}$ "
B.H.	10 (12)	...	...	25 "
Pitu		...	...	22 "
D.	602	...	...	10 $\frac{1}{4}$ "
R. H.	1	...	...	16 "
D.	419	...	...	5 "

RICE.

10. Rice work in the field has been chiefly confined to the propagation of pure line seed for distribution later through the medium of—(1) Inspected blocks; (2) Competitions; (3) Credit Banks.

11. Twenty acres were grown, 5 at Pln. Rosehall and 15 at Pln. Hogstye, Corentyne. The former suffered severely from adverse weather conditions, whilst the crop at Hogstye owing to the richness of the soil resulted in an over-production of straw and failed to produce grain.

The following quantities of seed was stored for future distribution:—Demerara Creole 94 bags; No. 79, 26 bags.

At Port Mourant 10 acres of Demerara Creole were grown from the Revolving Fund grant. The yield obtained was 26 bags per acre.

Two rice farmers competitions were held in the district in the same areas as those held last year, viz., Upper Corentyne and Bush Lot, West Coast. From these competitions a total of approximately 225 bags were reaped and stored by the growers for future seed supplies.

Eighty-nine bags of seed were sold through the Credit Banks. The crops obtained from this seed are to be reserved for seed purposes.

* Over 5 tons per acre.

12. The following are particulars of seed sold in the various districts from the bonds during the year:—

Corentyne Coast	...	...	130 bags.
Canje District	...	...	61 "
W.C. Berbice	...	...	59 "
Total			250 bags.

In addition to this 130 bags of surplus seed were sold to a miller.

Grading.

13. The following are summaries of the quantities of rice examined at New Amsterdam and Springlands:—

NEW AMSTERDAM.

Destinations.	No. 1.	No. 2.	No. 3.	Broken.	White Rice B.	Total.
Jamaica	...	2,500	...	...	...	2,500
Barbados	45	4,751	...	...	...	4,796
St. Lucia	...	35	40	...	...	75
St. Vincent	...	164	100	6	...	270
St. Kitts	...	860	775	...	5	1,640
Grenada	...	610	...	...	...	610
Trinidad	1	1,799	...	150	...	1,950
Antigua	...	1,180	470	...	...	1,650
	46	11,899	1,385	156	5	13,491

SPRINGLANDS.

Destinations.	No. 2.	No. 3.	Broken.	Totals.
Trinidad	1,000	...	...	1,000
*Guadeloupe	1,500	1,500	1,500	4,500
	2,500	1,500	1,500†	5,500

*New port unrecorded in 1931.

†500 re-graded and fees collected.

AGRICULTURAL EDUCATION AND EXTENSION.

Competitions

14. In this District the following agricultural competitions were held during 1932:—

For the best block of transplanted pure line seed padi (autumn crop) on the West Coast (Bush Lot) and on the Upper Corentyne (Villages 70-72), the area to be not less than half an acre.

1st prize	...	\$ 15
2nd prize	...	10
3rd prize	...	5

For the best miscellaneous farm on the East Bank, between New Amsterdam and Mara, the area to be not less than half an acre in extent.

1st prize	...	\$ 15
2nd prize	...	10
3rd prize	...	5

Prior to inaugurating these competitions every effort was made to make them as widely known as possible through the distribution of leaflets and personal talks. The rules governing the competitions were also fully explained, and in the case of the padi competitions, the importance of roguing was particularly stressed.

15. *Rice Competitions.*—The following were the points upon which the competitions were judged:—

General layout and preparation of nurseries and beds	...	30 points.
Uniformity of type and freedom from red grains	...	20 "
Freedom from weeds, pests and diseases	...	10 "
Yield	...	40 "

The seed had to be sown in nurseries and then transplanted. The crop had to be weeded and rogued of volunteer padi; the padi had to be hand or machine threshed and not bull mashed whilst all competitors who had purchased pure seed from the department were given a "pure seed certificate," twelve such certificates being issued this year.

Entries again this year were very satisfactory. On the Upper Corentyne 20 persons and at Bush Lot 16 persons recorded their names. Pure line Demerara Creole padi was distributed free to each competitor.

In view of the failure of the competition in the Upper Corentyne last year, due to the ravages of ducks, it was decided that another opportunity should be given to the farmers in the area to grow pure line Demerara Creole padi. It was particularly unfortunate, however, that the ducks again took their toll of the nurseries despite the efforts on the part of the owners to circumvent the pest, with the result that only seven of the twenty plots were eventually reaped. Of this number, only four complied with the conditions, hand threshing not being carried out.

The crops were grown on the old front lands in the first depths. Yields were not very good but the quality of the seed reaped was excellent and it is hoped that the successful competitors will utilise their crops for seed purposes. The winner of the first prize obtained a yield of 20 bags of 140 lbs. to the acre and might have obtained more were it not for the damage done by the ducks. The final results were as follows:—

Cooblall	...1st prize (\$15)—20 bags per acre.
Kallian	...2nd prize (\$10)—15 " " "
Chung-a-Ling	...3rd prize (\$ 5)—13 " " "

At Bush Lot, where 16 entries were recorded, the competition was very keenly contested by the farmers who went on to finality. The seed was sown in nurseries during June and all plots were transplanted by July 15. Growth was very good throughout and in some instances, plots had to be cut back, which had the effect of increasing tillering. Of the 16 plots, several were damaged by stray cattle during August, whilst only four reached the hand threshing stage.

It is interesting to place again on record the fact that the age of the crop, from sowing to maturity, was 153 days or 5 months. This fact so amply demonstrated last year on the West Coast will, it is expected, have negatived the belief amongst farmers that Demerara Creole is a six months' padi and, therefore, unsuited to local conditions. The rice lands at Bush Lot are now entirely planted with Demerara Creole. It is very encouraging to note that the seed grown in the last two competitions has found its way to other parts of the West Coast and indeed, it was with difficulty that the competitive and non-competitive plots could be distinguished from each other.

Yields were very good and even in the plots destroyed by cattle, on an average, 12 bags to the half acre were reaped. The winning plot yielded 3,084 lbs. or 44 bags per acre, and reflected great credit on the grower. The prizes were allocated as follows:—

Ramdanny	...1st prize (\$15)—44 bags per acre.
Jaimungal	...2nd prize (\$10)—43 " " "
Joe Mohabir	...3rd prize (\$ 5)—38 " " "

16 *Miscellaneous Farms' Competition.*—This competition was again repeated for the third year in succession amongst farmers on the East Bank, between New Amsterdam and Mara. The points on which it was judged were as follows:—

Drainage	...	...	30 points.
General layout and state of cultivation	...	...	30 "
Condition of crops, freedom from pests and diseases	...	...	20 "
Livestock (including poultry)	...	...	20 "

Entries were far from satisfactory this year, perhaps the persistent wet weather which prevailed during the first six and a half months of the year followed by a long dry spell had something to do with it. Generally speaking, drainage is usually good amongst the river farmers. The commonest fault and a bad one is the failure to back the dirt from the drains to the centre of the beds to give them a camber. Usually the dirt is left at the edge of the beds with the result that a hollow is formed in the centre where water collects during the rainy season.

The winner of the first prize, Mr. C. Daniels, of Sebastapool, who last year obtained a second prize, was the only entrant who obtained points for livestock. He had a very good show of poultry which forms a useful and remunerative sideline. With care, poultry thrive on the river but they need considerable attention and cannot be allowed to roam at will at all hours. Bees might well be kept by the river farmers which would be particularly advantageous especially where fruit is cultivated.

Most points were dropped in layout. Fruit trees of all descriptions grow readily but it is very seldom that they are planted with any system. They are usually mixed. The same remarks apply to ground provisions, which are mixed upon the beds instead of being planted systematically.

The prize-winners were as follows :—

Chas. Daniels, Sebastapool	... 1st prize (\$15)
A. Aaron, De Kinderen ...	... 2nd prize (\$10)
J. Frazer, Lighttown ...	... 3rd prize (\$ 5)

The Department has to express its appreciation and thanks to the Elected Members, Messrs. Eleazar, Luckhoo and Peer Bacchus, for kindly consenting to distribute the prizes in their respective districts to the various prize-winners.

School Gardens.

17. The small juvenile gardens established and commenced in 1931 met with some success at the outset. Planting materials and some tools were supplied and the area was fenced. Some good crops of black-eye peas, mung and sweet potatoes were reaped by the children and sold. Difficulties arose in holiday times when no one turned out. It appears that voluntary attendance cannot be expected and the only method to succeed is the compulsory one.

At the end of the year under review consideration was being given to the establishment of school gardens at two schools in this District under the ægis of the Department of Agriculture and the Education Department. This work will form part of the school's daily curriculum and will be run in collaboration with the Education Department which will be responsible for the discipline of the teachers and pupils and the Department of Agriculture for the agricultural activities in the gardens.

Garden Extension—Whim.

18. The sand reef immediately adjoining the Whim padi bond was fenced, forked up and a cover crop of bengal beans planted.

The overflow of a nearby well was tapped and led into a well in the fenced area.

A large nursery for raising seedlings was established. It is proposed during the coming year to carry out a programme of cultivation of crops as a demonstration for the district.

Ground Provisions.

19. The experiments carried out in collaboration with the Prison Department were continued. The lack of labour was, however, embarrassing at times.

The area previously under a manurial trial was replanted in May-June and reaped in November, in order to ascertain whether any residual manurial value remained for a succeeding crop. No residual indications were apparent. This may have been due to the fact that a long wet interval intervened before replanting, which may have caused leaching.

In view of the fact that ammonia was the only indicator with a positive reaction in the manurial trial conducted last year it was decided to lay out a new trial with graded doses of sulphate of ammonia only. Three Latin squares of 16 plots each were laid out. Treatments were controls 1, 2 & 3 cwt. per acre. Reaping of this trial was commenced in late December when the crop was 6 months old but was not completed until the beginning of January, 1933.

The propagation of sweet potato varieties commenced in 1931 was continued and a collection of all varieties procurable from various parts of the colony was made. Of these nearly all were exhibited at the B.G. Workers' League Exhibition held in Georgetown during the latter part of the year.

The varieties being extended are as follows :—

Red Nut Barbados.	Milton.
Caroline Lea.	Brook's Gem.
St. Vincent.	Philippine.
Black Sam.	Black Rock.
Pink Stem.	Turkey Foot.
Essequibo.	Chinese Slip.
White Stem.	Walkmen.
Garden Variety.	Strongman.
Strongman White.	Transparent.
White Gilkes.	

A record of descriptions of tubers and slips of each is in the course of preparation.

A collection of canavalia and bengal beans and crotalaria cover crops was established for further propagation.

Onions.

20. Great interest was created in the district by the onion cultivation which Mr. Carew conducted on a sand reef at Pln. Hogstye, Corentyne. The crop was grown from seed imported by the Department from Teneriffe. A crop of over 12,000 lbs. per acre was reaped and easily sold.

The success of this venture has proved a great incentive in the district and over 20 lbs. of seed were sold for the coming crop. Furthermore two onion growing competitions will be held in the Corentyne area for persons who purchased seed.

The Agricultural Instructor for the Corentyne was responsible for the advisory work conducted in connection with the onion cultivation at Hogstye.

Oil Palms.

21. Work was started at Macaw, East Bank, Berbice River, to clear land for establishing an acre of oil palms, in order to study their behaviour on the river soils. The acre was cleared and burnt off. Junking up of large trees was started. The main outlet drains were dug and a koker was also laid down. Canavalia beans were planted between the large junked up trees. The area was very heavily timbered and entailed considerable expense to clear it. The soil is a heavy loam overlying clay.

Citrus.

22. Some small extensions of cultivations have been made by individuals but there is nothing outstanding to report. During the year 210 budded oranges and 229 budded grapefruit were distributed in the district.

AGRICULTURAL INVESTIGATIONS.

23. The following is a summary of the work undertaken under this head :—

Estimates for the Rice crop were submitted.

The Land Settlement Commission was rendered every assistance during their stay in the district and was accompanied when possible.

A survey of the proposed land settlement area in the Kilmarnock-Springlands Empolder was made between Kilmarnock and Macedonia second depths.

A survey of a tentative nature was carried out in the eastern corner reef portion of the above empolder and samples of the soils on Bullet Wood Reef were submitted to the Chemical Division.

The Botanist was accompanied in his journeys of investigation relating to the pasture problem. The various typical pastures were inspected.

The agricultural census returns for the district were collated.

CO-OPERATIVE CREDIT BANKS.

24. There are four Credit Banks in the district. Those on the West Coast are under the chairmanship of the Superintendent and those on the Corentyne are under the chairmanship of the Agricultural Instructor for the Corentyne.

Meetings were held monthly. A full report of the proceedings is being published separately.

The collapse of rice prices has proved a great hindrance in the collection of outstanding debts, which though they have been reduced are still large.

MISCELLANEOUS.

25. His Excellency the Officer Administering the Government visited the district headquarters in New Amsterdam and later he was accompanied by the Superintendent on a tour of the manorial trials on the Prison Farm, and to Kilmarnock Empolder.

His Excellency the Governor of Surinam and party was accompanied from Springlands to New Amsterdam by a party including the District Commissioner, Inspector of Police and the Agricultural Superintendent.

A party consisting of Mr. F. A. Stockdale, the Director and Deputy Director was accompanied on a tour of inspection in the district.

26. *New Amsterdam Gardens.*—Owing to the scarcity of Prison Labour these gardens have suffered a severe set back.

Rainfall recorded during the year 96.71 inches.

27. *Reports.*—376 items of outgoing and 135 items of incoming correspondence were dealt with and the following are the chief reports submitted to the Director :—

Report on seedling extension by Sugar Estates.

Report on collection of outstanding debts in West Coast Credit banks, and renewal of notes.

Report on agricultural competitions.

Report on 1932 rice crop.

Monthly progress reports.

28. *Acknowledgments*—It is a pleasure to record my appreciation of the work of the staff during the year.

Sincere thanks are extended to the managers and staffs of sugar estates and to all agriculturalists for many courtesies.

HECTOR MACLUSKIE,
Agricultural Superintendent, Barbice.

January 14, 1933.

DEPARTMENT OF AGRICULTURE.

REPORT OF THE EAST DEMERARA DIVISION FOR THE
YEAR 1932.

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REPORT OF THE EAST DEMERARA DIVISION FOR THE YEAR 1932.

STAFF.

E. M. Peterkin	—Agricultural Superintendent.
C. C. Dowding, F.L.S., F.R.H.S.	—Agricultural Instructor, East Coast District.
D. D. Haynes	—Agricultural Instructor, Mahaica-Mahaicony District.
J. Indrobeharry	—Agricultural Assistant, Experiment Station.

GENERAL.

1. The experimental work on rice carried on at the Georgetown Station was handed over on the 1st of January to the Plant Breeder ; this enabled me to devote more time than had previously been possible to district work and increase the usual visits and inspections to small holders and estate cultivations during the year.

2. During the year the Government Veterinary Surgeon was absent from the Colony on leave from January 21 to September 5 and absent in the Rupununi from October 1 to December 16, during which periods I supervised the live stock and administered the Division.

3. I also acted as Deputy Director of Agriculture from September 6 to the end of the year under review during the absence from the Colony on leave of absence of the Deputy Director.

4. I was placed in charge of the Department's stand at the Workers' League Exhibition, where a large number of exhibits were greatly admired by the thousands of visitors who passed through during the three days' exhibition.

CROP CONDITIONS.

Sugar.

5. The long dry season at the end of the year which ran into the middle of December and the consequent lack of water for transportation purposes caused the sugar estates to stop grinding before all the farmers canes could be taken off ; this was very disappointing but was unavoidable. Reaping will not start again until February.

6. During the early part of the year there was a good deal of dissatisfaction among the cane-farmers with the payments made by the sugar estates, but at last a minimum price was fixed with an upward scale to be calculated on the market price of sugar, which appeared to be satisfactory to all parties.

7. The farmers at Beterverwagting, however, are still dissatisfied and are endeavouring to persuade the sugar estate authorities to give them their share of the sugar manufactured in lieu of cash payment for cane. Their argument is that by the sale of this sugar a greater monetary gain is obtained.

Rice.

8. The heavy continuous rains in the early part of the year—from March to June—hampered the reaping of the Spring crop of the Lower East Coast.

9. In the Mahaica-Abary District, which is entirely a rainfall (shied) area—no flooded (transplanted) rice being grown—only one crop per year, the autumn, is cultivated ; the heavy rains flooded and practically destroyed the whole of this area which had been seeded early. On the cessation of the rains nurseries were hastily started and about 50 per cent. of the area usually under cultivation was planted ; 600 acres of new lands were also planted. This and the extra yield from the transplanted area, however, compensated for the decrease in the area usually grown, so that there was no apparent shortage in the total output from the district.

A long dry season followed which continued to the middle of December ; this was responsible for the very poor yields which were obtained from some small areas. The crop in East Demerara was on the whole an excellent one.

EXPERIMENT STATION—GEOREGTOWN.

Bananas.

10. These will be transplanted to another section early in 1933. Large numbers of suckers have been distributed of the better known commercial varieties. The following varieties are under cultivation :—

Cinera Seramphur, Rajah (India), Martabanica, Red Fig, Jamaica, Apple, Cayenne, Sucre, Gros Michel, Dwarf, Giant Fig, Lacatan, Congo, Chan-A-Sue (N.W.D.), Almedo, Small Fig, Dacca, Rubra (India), Ramkela, Siam, Palembang, Celat, Serah (Indian Archipelago), Martinique (N.W.D.), Lady's Finger, Red Jamaica, Large Fig, Martaban, Pisang Su-su (Singapore).

Plantains.

11. A large number of suckers have been distributed. The varieties under cultivation are as follows :—

Apple, Surinam, Horse, Giant, Black, Pink and White.

Onions.

12. A large number of seedlings from seed imported from Teneriffe have been distributed. This practice will, however, be discontinued, as farmers are making no effort to grow their own seedlings and it is impossible to cope with the demand. Competitions have been started to counteract this practice.

Tobacco.

13. The demand for tobacco seed has continued. The seed collected from the varieties planted in 1931 and during the beginning of 1932 has all been distributed.

The following varieties have again been planted this year for seed :—

Comstock Spanish, Yellow Mammoth, Kentucky One Sucker, Hickory Pryor and Vaughan's White Burley.

Fresh seed has been imported of :—

Comstock Spanish, Yellow Mammoth, Standup Burley and Hickory Pryor.

The new seed is being planted at sub-station Cecilia where no tobacco has been grown for 3 years as a test for the presence of mosaic ; this disease is very prevalent and will, unless it is carefully controlled, greatly militate against the development of an industry.

Mangoes.

14. The grafted mangoes planted in the new area in South Field section A, beds 1, 2 and 3 are doing well ; a few have died, the others remaining are :—

24 Julie.
3 Mrs. White.
3 Jamaica No. 11.
1 Mrs. Dare.
2 Graham.
3 Pere Louis.
3 Black Bombay.

This collection will be added to as occasion permits.

15. The varieties growing on the old fruit dam did not fruit very well this year.

The following varieties have been established :—

- 12 Jamaica No. 11.
- 1 Dr. Rowland.
- 1 Julie.
- 3 Madam.
- 1 Canal No. 1.
- 1 Mrs. Clementi.
- 2 Egerton.
- 1 Chinoise.
- 2 Barroomshay.
- 1 Bangalore.
- 1 Ceylon.

Green Manures.

16. The following varieties are under cultivation :—

Crotalaria sericea, *C. usaramænsis*, *C. juncia*, *C. striata*, *C. quinquifolia*, *C. retusa*, *C. sp.*, *Stizolobium aterrinum*, *S. Deeringianum*, *S. niveum*, *Canavalia ensiformis*, *C. gladiata*, *Indigofera hirsuta*, *I. endecaphylla*, *I. sp.*, *Dolichos hosei*, *D. sp.* (Bush Bonavist), *Tephrosia Hookeriana*, *Centrosema pubescens*, *Calapagonium muconoides*, *Pueraria javanica*, *Phaseolus semi erectus*, *Sesbania sericea*, Woolly Pyrol, Black creeping Gram. (*Phaseolus Mungo* var. *radiatus*).

17. A greater interest is being shown by farmers in this line of work as evinced by the 337 lbs. of seed distributed this year.

The following notes on the different varieties may be of interest :—

Crotalaria sericea and *C. quinquifolia* were drowned out by the heavy rains in the early part of the year.

Crotalaria retusa is of too poor a growth to warrant any further interest.

The cowpeas are of too poor a growth and of too short duration and cannot be compared with black eye peas. An indigenous *Vigna* is being experimented with.

Dolichos lablab is disappointing and will not seed.

Canavalia sp. (red seeded) and *Desmodium tortuosum* both perished in the early rains.

Sesbania sericea is too woody at an early age to be of any value.

Dolichos hosei should do well for use in orchards or coconut cultivations as it forms a perfect mat and is a poor climber; it is a very shy seeder but is easily propagated from cuttings.

Centrosema pubescens, *Calapagonium muconoides* and *Pueraria javanica* are promising.

Indigofera endecaphylla also makes an excellent cover and is easily propagated by cuttings.

Fodder Crops.

18. Section C, South Field, which had previously been utilised for a plantain experiment, was cleared, forked and planted with the following :—

No. of bed.	Variety.	Area Sq. rods.	Date planted.	Date first cutting.	Yield per acre lbs.	Date second cutting.	Yield per acre lbs.	Distance planted ft.
29	Guinea Grass	84	5.2.32	27.5.32	12,000	26.7.32	16,500	3 x 3
30	Wynne Grass	62	5.2.32	27.5.32	8,700	...	...	6 x 6
31	Guatemala Grass	62	9.2.32	27.5.32	14,700	26.7.32	24,600	5 x 5
32	Demerara Primrose	84	8.2.32	...	...	...	...	2 x 2
33	Para Grass	84	9.2.32	27.5.32	18,000	26.7.32	17,400	2 x 2
34	Elephant Grass	84	12.2.32	...	...	26.7.32	35,100	3 x 5
35	Alysicarpus	84	20.2.32	...	...	...	...	1½ x 1½
36	Uba Cano	84	20.2.32	...	...	...	...	2 x 4

19. The Wynne Grass practically died out during the spell of dry weather following its being cut in May.

20. The Demerara Primrose, which was planted from cuttings, was just getting established when the long dry season arrived; the grass and weeds got well away and covered it down, but on examination it was found to be gradually establishing itself under the shade afforded by these. It was scythed at the end of November, and with the end of the year rains is making rapid progress.

21. The Elephant Grass was too low to cut in May so was not reaped until July.

22. The *Alysicarpus vaginalis* was planted from cuttings which made very slow growth at first but is now rapidly establishing itself and is seeding freely. It grows well together with grasses but tends to become fibrous when grown alone.

Fibres.

23. *Manilla Hemp*.—The 12 suckers obtained from St. Vincent in July, 1930, have tillered so freely that it was possible to extend them over an area of 80 square rods. The drought, however, retarded growth to some extent.

SUB-STATION CECILIA.

Tomatoes.

24. Plots of the following varieties were planted from seed obtained from Messrs. Sutton & Sons, England:—

Tenderloin, Early Market, Beauty and Golden Queen.

From seed obtained from Messrs. Peter Henderson & Co., U.S.A.:—

Marglobe and Crimson Cushion.

The following table gives all data in connection with same.

Variety.	Date Sown.	Date Trans- planted.	Reaping period.	No. of Stems.	Area planted. Sq. feet.	Yield per plot. Lbs.	Yield per acre. Lbs.	Prevalence of Blossom- end rot.	Preval- ence of Mosaic.
Tenderloin ...	23.11.31	21.12.31	16.2.32 30.6.32	2	512	108	9,188	Very bad ...	Nil
Early Market ...	23.11.31	22.12.31	26.2.32 8.7.32	2	163	191	14,423	Very slight	Nil
Beauty ...	23.11.31	22.12.31	24.2.32 30.6.32	2	512	100	8,508	Very bad ..	Nil
Golden Queen ...	23.11.31	17.12.31	27.2.32 21.5.32	2	368	79	11,172	Slight ...	Nil
Marglobe ...	23.11.31	17.12.31	18.2.32 16.5.32	1	615	35	2,472	Very bad ...	Nil
Marglobe ...	23.11.31	17.12.31	18.2.32 8.7.32	2	615	164	11,616	Very bad ...	Nil
Crimson Cushion ...	23.11.31	22.12.31	26.2.32 16.5.32	2	750	29	5,766	Bad ...	Nil

Onions.

25. Seed obtained from Teneriffe was sown on November 12, 1931, transplanted on December 19, and reaped during the period March 29 to April 20, 1932. The area planted was 1,538 sq. feet from which 569 lbs. of onions were reaped equivalent to 16,115 lbs per acre. Besides this plot large numbers of seedlings were grown in nurseries and distributed as seedlings.

Soya Beans.

26. An area of 3,530 sq. feet sown on November 14, 1931 and reaped during the latter half of February yielded 108 lbs. equivalent to 1,333 lbs. per acre. The poor yield was due to poor germination, great difficulty being experienced in maintaining the viability of seed stored over any period.

A plot of 2,592 sq. feet was sown on May 19, 1932, and reaped during September of that year; the yield was 102 lbs. equivalent to 1,714 lbs. per acre.

Both of these plots were spaced 18 ins. x 4 ins.

On December 19, a plot of 825 sq. feet was sown.

These plots were all sown on the same area on which soya beans have been grown for 4 years.

On the same date a plot of equal size was planted on land which had never been planted with soya beans with the object of comparing the germination, growth and yield on land where no inoculation had taken place. The germination of both these plots was about 85%—the best so far obtained.

Miscellaneous Crops.

27. *Crowa*.—The plants put out during November, 1931, have made poor growth. This collection of different types was made for reference only.

28. *Pineapples*.—The majority of these have died out and the plots have been discontinued.

29. *Legumes*.—Large quantities of seed of bengal bean, canavalia, dwarf and bush bonavist, lima bean, urid, mung and sinebone have been distributed free. The practice is still being continued of covering down with a legume any area at the station not being used for an experiment.

30. *Sweet Potatoes*.—The plots planted in 1931 suffered severely from the heavy and continuous rains during April and May and were discarded. The only data of any value obtained was that the potatoes planted on ridges did not suffer as much as those planted flat. The cuttings obtained were distributed free.

31. *Chinese Yams*.—Tubers obtained from Trinidad were planted on April 11, and tubers from St. Lucia on May 15. Both plots are 216 sq. feet in area and the tubers are spaced 3 ft. x 3 ft.

32. *Grapes*.—The cuttings and buds sown in 1931 were planted out in May, 1932, and have all made excellent growth. An arbour has been erected for them to run on, and some are being grown on the spur system. These were given a dust mulch early in the dry season and stood up to the drought excellently. In November they were given a mulch with rice straw. Great interest is being displayed in this trial. Young plants are being established for distribution to selected farmers.

33. On the arrival of the rains on December 15, the entire station, which had suffered severely from the long drought, was forked and new plots laid down as under:—

Tomatoes—Early Market	...	815 sq. feet
Marglobe	...	815 sq. feet
John Baer	...	815 sq. feet
Bonny Best	...	815 sq. feet

34. The following beans obtained from Uganda, Nigeria and Porto Rico were planted in plots of 450 square feet each:—

Venezuelan Black Bean, Ordinary Mutike, Red Mutike, Black Mutike, Blue Mutike, Magulu Ga Namunye, Bitango, Neavy, Kaija, Serere, Lima S.L.3, Lima U.S. 3, Lima N. 4, Ordinary Lima, Small Lima or Rangoon Type and Indigenous Popondo.

And similar sized plots of the following local beans :—

Lima, Bush Bonavist and Dwarf Bonavist.

Besides these there are plots of :—

Cowpeas, Mung, Sinebone, Urid ;

35. *Green Manures*—*Canavalia ensiformis*, *C. gladiata* and *Stizolobium aterrimum*.

36. *Tobacco*.—Seed has been sown of the following varieties :—

White Burley, Gold Leaf, Station Standup Burley, Comstock Spanish, Yellow Mammoth and Hickory Pryor.

37. *Chilli Pepper*.—Seed has been sown of the following varieties :—

Tanjore, Long, Round, Godavari Big, Godavari Small, Tinneveli, Guntur No. 1, Guntur No. 2 and Jerusalem.

38. The total number of visitors during the year was 1,035. The northern and eastern sides of the fence have had to be renewed.

The supervision of this station is carried out by Mr. C. C. Dowding, the Agricultural Instructor of the District.

DISTRICT WORK.

Cane-Farming.

39. Sugar cane has been cultivated by farmers in the village of Buxton since 1887, and Beterverwagting some time later. This year there has been a marked increase in the acreage under cultivation in these villages.

40. The improvement in the drainage and the widening of the middle-walk where required at Buxton, with money obtained from the Unemployment Relief Fund by the District Commissioner, has given a big impetus to cane-farming in this village and the area under cane is steadily increasing. At Beterverwagting there is also a marked increase, many rice-beds are being prepared for cane.

41. Great stress has been laid on the importance of block cultivation in relation to reaping, flooding, etc., of these areas and three Agricultural Competitions were advertised to take place during 1932 in the villages of Buxton, Beterverwagting and Victoria for the best established co-operative block of sugar cane of not less than 10 acres of one commercial variety. A first prize of \$60 and a second prize of \$40 to be awarded in each district, the prize money to be divided on an acreage basis amongst successful farmers of the winning blocks.

Unfortunately, the competition had to be abandoned for not a single entry was received. The Director, accompanied by the Deputy Director, the Agricultural Superintendent and the District Commissioner, paid a special visit to the cultivations of these villages, in order to explain at length the benefits to be obtained from block cultivation.

42. An effort was made by the District Commissioner assisted by the Agricultural Officer to establish a cane-farming industry at Golden Grove and Nabacelis, and the farmers readily promised to prepare their land and to grow same. In May the District Commissioner was informed that there were 47 acres ready for planting ; on examination it was found that only 10 acres were prepared, and this in small scattered areas. This haphazard method prevented plants being obtained at a proper time ; by the time their application was received the estates had finished

grinding and no plants were available. Black eye peas were offered free to plant the prepared areas for the period to the next reaping season, very little of this was applied for, and of that not all was sown.

By the end of the year there were 50 acres under cultivation in this area, but very much scattered.

43. At Beterverwagting and Buxton black eye peas were offered free to farmers to plant between the rows of plant canes, this would not only save weeding but would be a quick money crop. Most of the peas remained on hand and were eaten by weevils; those who asked for seed planted an absurdly small area.

44. There was a severe attack of *Aphis* from June onwards which is gradually disappearing.

Rice.

45. The extension of the area under pure-line padi in the district has been considered of special importance and every effort made to stimulate an interest in this amongst farmers of every class. Once an area of pure-line is established in any village or estate its superiority over mixed and poor types is quickly discernible in the field as far as uniformity of growth, maturity and type are concerned, while its robustness and yield are striking, even at a casual glance; this quickly awakens the interest of other farmers and the area is considerably increased for the next crop.

46. Early this year a strenuous effort was made, with the help of the District Commissioner, East Demerara, to interest the villages in the cultivation of pure-line padi. Meetings were held under the chairmanship of the District Commissioner, at different villages, to which rice-farmers and millers were invited and the advantages to be derived from planting pure-line seed were explained and orders for same were booked. Seed was issued on credit to some villages on the personal guarantee of the District Commissioner.

The villages Helena, Unity and Clonbrook have made a very creditable start. The high price of the seed and the prevailing low price of padi and rice hampered expansion considerably.

47. Five acres of land were rented on the front of Pln. Nonpareil, a mere built around it and the five acres irrigated as a whole. Three ploughings were given at fortnightly intervals. Seedlings were supplied from the Georgetown Station. Irrigation was controlled by the estate under our supervision; careful roguing was carried out; hand-threshing was practised. This area yielded 115½ bags padi of 140 lbs. nett. The padi is stored in the Department's bond at Golden Grove.

The entire supervision was carried out by Mr. C. C. Dowding, Agricultural Instructor of the District.

48. The rapid expansion of the area under pure-line padi in the different rice-growing districts of the Colony has resulted in very large quantities of so-called pure seed padi being available for seed purposes. This padi, however, varies considerably in percentage of purity and can be purchased at a cheaper rate than pure seed grown by the Department.

49. During 1932 great difficulty was experienced in selling all of the padi purchased from the "Revolving Fund," and in 1933 the risk of losses from the use of this fund will be great. This fund has been extremely valuable in getting a good start made as regards pure-line padi distribution, but I consider that this should now be discontinued.

The objects to be aimed at are as follows :—

- (a) Maintaining the purity of already established pure-line areas.
- (b) Increasing the area under pure-line padi.
- (c) Increasing the volume of pure-line padi available for distribution.

The following "Pure-line Padi Loan Scheme" for 1933 has been submitted to, and approved of, by the Director and Government.

- (1) Instead of selling seed padi it should be given out on loan, on condition that it must be returned or paid for as required by the Agricultural Officer of the District.
- (2) The return and/or payment for the padi to be based on the quality and purity of the seed.
- (3) Where paid for the price for 1933 to be \$1.20 per bag of 140 lbs. nett, the price to be fixed annually by the Director of Agriculture.
- (4) The seed padi for 1933 to be loaned only to selected farmers who should be approached by the Agricultural Officer of the District.
- (5) The farmer to sign an agreement.

50. To enable this to be carried out it will be necessary for the Department to increase the pure-line blocks at the District stations in addition to that grown at the Georgetown Station.

Padi will be grown at the Experiment Station, Georgetown, by the Plant Breeder. Sufficient seed will be issued from here each year to the Agricultural Superintendents for extension at the District Stations.

51. The seed from the District Stations will be ear-marked primarily for maintaining the purity of already established pure-line areas, and any remainder to establish new areas. From 1934 the loaned padi returned will be used for establishing new areas, and Government-grown seed only for already established areas. For the first two years there should be no more padi returned and grown by Government than can be distributed on loan; the amount handled will be controlled by the storage capacity of the existing padi barn in the district. When the revolving padi increases beyond what can be stored another bond can be erected if conditions warrant it or the surplus sold at market rates.

52. The sale of padi can still be carried on (and may be necessary in 1933) through proprietors of established pure-line areas of proved integrity to whom certificates can be issued to sell seed padi at a price arranged with the Department.

Cocoanuts.

53. There are a few estates where attention is being given to drainage and cultivation, but there are many others, especially small cultivations, suffering from neglect. Yields on the whole are fair; prices are, however, low. This fact accounts for the neglect on many of the plantations.

54. *Brassolis sophoræ* was present but not to the same extent as previous years. Control measures, especially breeding of parasites, are being carried out on an extensive scale at Plns. Letter T, Park (Mahaicony) and at Hope (Lower East Coast). Observation gangs have been regularly employed with satisfactory results. There was also an outbreak of cockles (*Strategus aloeus* Fabr.) in the Mahaicony District.

Ground Provisions and Vegetables.

55. The farmers in the villages are beginning to realise that they cannot compete in the open market with ground provisions from the river districts, and are giving more attention to sugar cane, rice and coconuts and reducing ground provisions to areas more commensurate with village requirements.

Interest is being awakened and a lot of work done in the preparation, into manufactured products (for their own use and sale) of surplus cassava, plantains and bananas.

It is pleasing to note that many farmers are cultivating crops in more marketable quantities and discarding the old method of miscellaneous mixture, many items of which are unmarketable.

56. *Tomatoes*.—Strenuous efforts have been made to establish tomato growing in the villages of the East Demerara District. There is a good local demand for this fruit which is never met, and if a few farmers suitably situated would systematically cultivate the crop, a remunerative local industry could be built up.

The soils best suited to this crop are the sand reefs and adjoining loams; clay soils are unsuitable unless very efficiently drained and thoroughly tilled and prepared.

57. Experiments have been conducted at sub-station Cecilia since 1928 with freshly imported seed, each succeeding year, from the U.S.A. and England; this year two varieties from Canada have been added, excellent results having been obtained. Seed and seedlings have been distributed, last year and again this year every farmer who visited Cecilia has been given for trial a couple of ripe tomatoes as a source of a small supply of seed. During the year under review the following quantities have been distributed:—

3,000 seedlings grown from imported seed.
250 lbs. ripe tomatoes.
3 lbs. dried seed.

58. Field days have been held at sub-station Cecilia when the farmers were instructed as to proper spacing and pruning, different methods of staking the plants demonstrated, and the control of insect pests and diseases explained. Besides this, special attention and advice have been given to farmers cultivating tomatoes in the villages.

59. It is disappointing to state that up to date the progress made is poor. The principal difficulties met with have been—

- (1) Reluctance of individual farmers to plant any large quantity.
- (2) Farmers do not take kindly to the cultivation of any specialised crop that requires any great attention; they prefer to grow crops that require little attention and that can be reaped and handled roughly, such as sugar cane, rice or ground provisions.
- (3) Low fertility of the average farm. No rotation is practised; everything is taken out of the soil and nothing replaced. The good yields at Cecilia are attributable to rotation with a legume cover crop. Farmers cannot or will not realise the importance of this.
- (4) Inadequate water supply during dry weather; even where water is available the farmers will not water the plants regularly.
- (5) Neglect of pruning and general training of the plants.

- (6) Diseased plants are not destroyed when suffering from Mosaic, and diseased fruits for other causes removed, and the entire plot is soon diseased.

This work, however, is being continued.

60. *Peas and Beans*.—Poor progress has been made in the effort to stimulate the production of peas and beans; large quantities of seed of black eye, mung and pigeon peas, lima and bonavist beans have been distributed free, besides small quantities of others; but the area planted remains the same. There is a great local demand but no effort is made to meet it in spite of the encouragement given by the Department. As will be seen from the distribution list 643 lbs. of seed were distributed free during 1932.

61. *Onions*.—The growing of onions is becoming very popular; the seed is imported by the Department from Teneriffe and sold at 12 cents per ounce. Farmers experience great difficulty in raising the seedlings, the principal cause being poor preparation of the nurseries and lack of attention in watering and shading the very young seedlings. In 1930 and 1931 large quantities of seedlings were grown and distributed, but this year an effort was made to get the farmers to grow their own seedlings.

62. To encourage this, competitions were started in Beterverwagting and Buxton villages for the best block of onions grown from seed obtained from the Department of Agriculture, the area to be not less than 5 square rods, the seedlings to be grown by the competitor. For this a first prize of \$5 and a second prize of \$2 were offered. Great interest has been displayed and a fair number of entries received.

School Gardens.

63. The garden started at Beterverwagting village during 1931 for the benefit of the village children of different races, schools and denominations, has proved a failure; the fencing is broken down and cattle are grazing on the area. Every effort was made to ensure success, tools, seed and seedlings being supplied free by the Department, in addition to regular instruction by the Agricultural Instructor of the District; but a lack of interest and sense of responsibility on the part of the head teacher as well as the children was responsible for its failure.

Home gardens for the children under the existing conditions of life in the villages are, with a few exceptions, an impossibility.

Lodge Village Allotments.

64. As mentioned in the Annual Report for 1931, the Lodge Village Allotment Scheme was started in May, 1931, when the northern section of an area of crown lands, situated to the east of Lodge Village, was divided into 59 allotments and given out to 59 members of the unemployed, free of rent for one year.

65. In April of this year His Excellency approved of the southern section of this area being allotted to unemployed members of the Labour Union and an expenditure of \$700 was authorised for the purpose which covered the digging of irrigation and drainage trenches, fencing, tools and purchase of seeds and plants. The trenches were dug on the same basis as in the adjoining allotments namely, Government paid half the cost and the farmers contributed the other half in labour.

66. The old fencing separating this area from the Lodge Village and the La Repentir Cemetery was found to be useless, most of the posts had rotted and fallen down and the wire rusted and broken. This had to be entirely renewed. A tool house was erected under Sergt.-Major Fraser's house and tools purchased for the

use of those taking up the allotments. These tools were issued *on loan only* to be returned every evening. Great difficulty, however, was experienced in making the allotment holders do this as the majority took the tools away, months elapsing before they were eventually returned whilst a few were never returned.

67. Seeds and seedlings were issued by the Georgetown Station and vegetable seeds, banana and plantain suckers, cassava cuttings, etc., were purchased and distributed.

The quantities thus issued are as follows :—

Banana suckers	...	...	2,100
Plantain suckers	...	...	1,000
Sweet Potato cuttings	...	...	2,000
Cassava sticks	...	...	1,500
Papaw seedlings	...	...	100
Pepper seedlings	...	...	100
Black eye Peas	...	...	180 lbs.
Tomato seed	...	...	4 ozs.
Tomato seedlings	...	...	1,500
Onion seedlings	...	...	8,000

In addition, seeds of pigeon peas, bush bonavist, ochre, squash, pumpkin, (seed and seedlings) have been distributed. Further, vegetable seed has been purchased and issued to various farmers.

68. Although the allotments, 56 in number, were given out in May, the heavy rains which prevailed about that time prevented a start being made until the middle of July. A number of the persons to whom these plots were issued did not even know how to handle an agricultural tool and although advice was given, including actual demonstration, they never succeeded in attaining any standard of proficiency and so, of necessity, had to be replaced. This state of affairs has continued and will continue indefinitely. A few have made good but the majority have not due to the following reasons :—

- (a) Refusal to carry out instructions given.
- (b) The internal drains are not dug, or if this is done, not deep enough.
- (c) The irrigation and drainage trenches are not kept clean.
- (d) Irrigation water is wasted.
- (e) Seeds and plants are wasted and allowed to perish.

In short, they require someone always with them to put right what is wrong and to do what has been left undone ; to be brief, this ~~lack of interest~~ indicates only too plainly their absolute lack of interest and indifference in the allotments given them. The condition of the farms in both sections, with few exception, is unsatisfactory, but their excuse has been the very dry weather experienced during the last few months of the year. Needless to say, this area has never been put on time-run and water has been available over the whole of the dry period but no use has been made of it. It can only be hoped that with the present rains there will be some improvement in cultural habits and the general state of the cultivations during 1933.

69. Sergeant-Major Fraser who has been acting as the unpaid supervisor of the allotments deserves the thanks of the Department for the work he has put in.

AGRICULTURAL EDUCATION.

Competitions.

70. *Rice*.—During the year two Rice Farmers' Competitions were held in the East Demerara District, one on the Lower East Coast and one in the Mahaica-Abary District, the conditions in each district being as under :—

For the best block of transplanted pure-line seed padi, the area to be not less than half an acre :

1st prize	...	...	\$ 15
2nd „	...	...	10
3rd „	..	...	5

The varieties of padi used were Demerara Creole and No. 79. In the case of new entrants pure-line seed was supplied by the Georgetown Station whilst a small quantity was grown by the competitors and came up to the Department's required standard of purity.

71. The padi blocks were judged on the following points :—

General layout and preparation of nurseries and beds	...	30 points
Uniformity of type and freedom from red grains	...	20 points
Freedom from weeds, pests and diseases	...	10 points
Yield	...	40 points

The padi had to be threshed and not bull mashed ; the padi reaped was to be sold as far as possible for seed purposes.

72. The 55 entries in the Lower East Coast (Kitty-Mahaica) District were from Pln. Nonpareil, Helena Village, Clonbrook, Unity and Lancaster Villages ; the greatest number of entrants being from Pln. Nonpareil. Competition was keen throughout, and it is pleasing to note that the majority of the entrants carried out, in a very thorough manner, instructions given by the Divisional Officers, resulting in the high quality and purity of the padi produced. Unfortunately, however, 46 competitors refused to hand-thresh the padi and so were compelled to withdraw from the competition, chiefly attributable to the poor price of padi which was also the case in the Mahaica-Abary competition.

Although these farmers did not participate, the Agricultural Instructor made every effort to persuade them to prepare proper "karians," with the result that a very clean sample of padi was obtained.

73. At Helena, Unity and Clonbrook Villages, a small thresher, complete with 1½ H.P. engine, borrowed by the District Commissioner from Messrs. Booker Bros., McConnell & Co., Ltd., was tried, but very few farmers availed themselves of this, their excuse being that with the low price offered for padi they were unable to pay the 8 cents per bag charged.

74. The nine final competitors obtained good results, great attention having been paid to the nurseries and layout of beds. On the whole the competitors did good work and are to be commended. The first prize this year has been won by a villager who used pure-line No. 79 and obtained a yield of 18½ bags from half an acre.

The prize-winners were as follows :—

1st prize	...	(\$15)—Kissodar, Clonbrook.
2nd prize	...	(\$10)—Bissoochand, Helena.
3rd prize	...	(\$ 5)—Chintaman Maraj, Helena.

75. Considerable interest was displayed in the Mahaica-Mahaicony District in the competitions, a total of 108 entries being recorded from Fairfield, Good Faith, Sophia's Hope, De Hoop, Supply and Felicity.

76. The long spell of dry weather rendered it impossible to irrigate the beds when it was most urgently required ; consequently the plots suffered very badly, particularly at Fairfield from where 64 entrants were received. This affected the yield in a marked degree ; the percentage of wind rice and light grains was abnormally high.

77. About 80 per cent. of the competitors had to be eliminated as their plots failed to attain the standard required. Of the remainder only nine hand-threshed their padi, the low price of padi and the extra cost of this operation influencing them. The principal fault in "bull mashing" is the preparation of the "karian" or threshing floor. If greater attention was given to this work the results would be more satisfactory.

78. As on the Lower East Coast there was a marked improvement in the cultivation of the plots. It was unfortunate that adverse weather conditions affected the good work put in. The winner of the first prize used pure-line Demerara Creole and obtained a yield of 14 bags from his half acre plot.

The prize-winners were as follows:—

1st prize	...	(\$15)—Wilfred John, Sophia's Hope.
2nd „	...	(\$10)—Latchoo, Good Faith.
3rd „	...	(\$ 5)—J. A. Williams, Sophia's Hope.

79. *Sugar-Cane*.—In addition to these rice competitions, efforts were made to run three sugar cane competitions on the co-operative block system in Buxton, Beterverwagting and Victoria Villages but with negative results. Reference to this is made in paragraph 41 under cane farming.

80. It is, however, proposed to run one competition on the same lines during 1933, when it is hoped that more interest will be taken in it. The suspicious attitude adopted by one farmer towards another greatly hinders any attempt at co-operative work in the villages.

81. *Onion*.—Two onion competitions were started in the villages of Beterverwagting and Buxton in order to encourage farmers to grow their own seedlings, which has hitherto been done by the department. Details of this competition are given in paragraph 62 where the development of an onion industry is discussed.

Farmers' Day.

82. A Farmers' Day was held at Sub-station Cecilia on February 22, when 800 persons, including school children, visited the station. The day was divided into two sessions, the morning for farmers and the afternoon devoted to school children; the latter visited in schools attended by their teachers. The nature and objects of the experiments were explained and questions answered.

83. Farmers frequently visit this station in batches and are given informal talks on the preparation of seed beds, requirements and uses of the crops grown, proper storage of seed, the benefits of rotation and leguminous cover crops, simple selection work, etc.

Exhibitions.

84. *B.G. Workers' League Exhibition*.—The Workers' League staged their second exhibition—the first being held in 1930—at the Promenade Gardens from October 20 to 22. A stand was erected and a Departmental Exhibit staged; this was made as educational as possible. In addition to the principal crops, sugar, rice, coconuts, coffee, cacao and limes a special feature was made of legumes (green manuring and edible), fodder crops, varieties of sweet potatoes, budding, grafting and Apiculture. Exhibits were also staged by the Entomologist, Mycologist, Chemist-Ecologist, Plant Breeder and the Rice Grading Officer.

85. The exhibits for competition were on the whole disappointing, the fruit and vegetables were below the standard to be expected for an exhibition of this kind, both in quantity and quality; very little care was taken in the preparation of these exhibits to render them attractive. A list of hints to exhibitors could, with advantage, be given a prominent place in the next prize list issued. The poultry

exhibit was good but the livestock was extremely poor, a milch goat exhibited by Mr. W. H. M. A. Roberts is, however, worthy of mention.

86. The Department awarded Diplomas of Merit to exhibits in any way related to agriculture.

87. *Buxton Farmers' Union Fair*.—The Buxton Farmers' Union, which is affiliated to the British Guiana Producers' Association, held a fair on August 16. A meeting was first held at the Cinema Hall at which the report on the year's working was discussed and adopted. The Director of Agriculture presided and addressed the meeting on agriculture generally, and stressed the importance of extending cane-farming on the co-operative block system. The following papers were also read by Officers of the Department :—

“Cane-Farming” by the Cane Agronomist.

“Rice Cultivation” by the Agricultural Superintendent, East Demerara.

“Tomato and Onion Cultivation” by the Agricultural Superintendent, East Demerara.

“Rice and its Improvement by Breeding” by the Plant Breeder.

“Fruit Cultivation” by the Superintendent, Botanic Gardens.

“Insect Pests” by the Entomologist.

88. The Fair was opened by the District Commissioner. The number of exhibits was poor but the quality of those displayed was good ; it was pleasing to note that an interest is being awakened in market garden crops ; peas and beans were poorly represented—it is extremely difficult to persuade farmers to grow these even when the seed is given to them free. The exhibit, displaying an effort made to dry some of their surplus crops, for future use, as well as converting them into manufactured products for their own use and sale, is worthy of praise ; much could be done in this line to save the waste which occurs from over-production in certain seasons in all of the villages ; this refers more especially to plantains and cassavas.

CO-OPERATIVE CREDIT BANKS.

89. During the year I have continued the Chairmanship of the Plaisance-Sparendaam, Beterverwagting-Triumph and Buxton-Friendship Co-operative Credit Banks ; I also assumed the Chairmanship of the Georgetown Co-operative Credit Bank in June owing to the secondment of the Deputy Director for other work.

90. Monthly meetings were held at each bank, numerous visits had also to be paid to deal with other business. An effort has been made to bring the outstanding judgments for unpaid loans up to date by renewing the notes where necessary. On the whole there has been a slight improvement in conditions.

91. Mr. Dowding, Agricultural Instructor, also continued the Chairmanship of the following Banks :—Ann's Grove, Golden Grove and Victoria.

92. A separate report on these banks will be issued by the Secretary of the Banks' Committee.

SEED DISTRIBUTION.

93. Plants, cuttings and seeds of field crops were distributed during the period under review to farmers and others throughout the colony as given in the following summary :—

Padi	...	...	95,140 lbs.
Peas and Beans	...	...	643 „
Legumes (cover crops)...	...	...	337 „
Tobacco	...	...	2½ „

Tomato seed	...	10 ozs.
Tomato seedlings	...	4,130
Onion seed	...	92 lbs.
Onion seedlings	...	10,200
Sweet Potato cuttings	...	6,300
Artichoke tubers	...	19 lbs.
Banana suckers	...	2,244
Plantain suckers	..	1,060
Cassava cuttings	...	6,000
Indian Kale suckers	...	230
Papaw seed	...	2 lbs.
Papaw seedlings	...	124

Fodder Plants—

Demerara Primrose	...	4,850 plants.
Elephant Grass	...	2,725 „
Guatemala Grass	...	5,850 „
Uba Cane	...	400 „
Wynne Grass	...	150 „

and considerable small quantities of seeds and seedlings of vegetables and quantities of cuttings of fodder plants not only to farmers and others in the East Demerara District, but to other parts of the colony including the Rupununi District and the Mazaruni Mining District.

SEED AND PLANT INTRODUCTION.

94. The undermentioned seed and plants were received :—

- Chinese Yam—4 lb. tubers—from Department of Agriculture, Trinidad.
- Chinese Yam—2½ lb. tubers—from Department of Agriculture, St. Lucia.
- Pigeon Peas—2 lbs. seed—from Department of Agriculture, Hawaii.
- Tomato “Early Market”—6 ozs. seed—from the United Kingdom.
- Tomato “John Baer” and “Bonny Best”—8 ozs. seed—from Canada.
- Tomato “Marglobe”—4 ozs. seed—from U.S.A.
- White Sunflower—2 lbs. seed—from Department of Agriculture, Barbados.
- Chilli Pepper—2 varieties—from Department of Agriculture, Guntur, South India.
- Chilli Pepper—1 variety—from Department of Agriculture, Tanjore, India.
- Chilli Pepper—1 variety—from Department of Agriculture, Madras, India.
- Chilli Pepper—4 varieties—from Department of Agriculture, South India.
- Chilli Pepper—1 variety—from Department of Agriculture, Jerusalem, Palestine.
- Tobacco “Comstock Spanish,” “Standup Burley” and “Hickory Pryor”—1 packet each—from Department of Agriculture, Canada.
- Tobacco “Yellow Mammoth”—1 packet seed—from Department of Agriculture, U.S.A.
- Beans—Lima S.L.3, U.S.3, N.4, Ordinary Lima, Small Lima or Rangoon type, Popondo—from Department of Agriculture, Nigeria.
- Beans—Venezuelan Black—from Department of Agriculture, Porto Rico.
- Beans—Ordinary Mutike, Black Mutike, Red Mutike, Blue Mutike, Bitango Magulu, Neavy, Kaija, Serere—from Department of Agriculture, Uganda.
- Cowpeas—from Department of Agriculture, Uganda.
- Sweet Corn—from Department of Agriculture, Porto Rico.
- Crotalaria spectabilis*—from Department of Agriculture, U.S.A.

GENERAL REMARKS.

95. Funds provided through the Unemployment Relief Fund have been utilised to ameliorate conditions in the villages generally, more particularly in connection with drainage. Navigation canals have been widened in Buxton Village to assist

the extension of cane-farming there whilst Victoria Village is being connected up with Plantation Enmore by means of a canal for the purpose of starting cane farming in Victoria and adjoining areas.

96. Arising out of complaints received from the Beterverwagting rice farmers regarding poor yields, an effort was made to launch a scheme for improving yields and establishing pure-line padi in this village. The poor yield was attributed to the fact that the greater percentage of land under rice had been cropped twice annually for a number of years, and was always in a water-logged condition. It was recommended, therefore, that no 1933 spring crop should be grown and that the area be completely dried off. When being prepared for the autumn crop three ploughings instead of the usual one should be given at fortnightly intervals, to ensure thorough cultivation and the elimination of volunteer seedlings. The Department was prepared to loan them sufficient seed to plant the whole of the area and to run a special competition for this village, also to detail an officer to supervise all cultural operations.

97. Meetings were held, and the District Commissioner promised to obtain sanction from Government to remit half the rates for any areas which came into the scheme. Unfortunately, owing to lack of co-operation and political squabbles, the scheme fell through.

98. A private pure-bred piggery has been established at Pin. Hope, piglets having been purchased from the Livestock Farm. Runs have been put down on lines similar to those at the Stock Farm. This venture shows signs of great success. Pure bred piglets have also been bought by Mr. R. G. Humphrey and sent to the Mazaruni where they are doing well.

MISCELLANEOUS.

99. *Reports.*—The following have been submitted to the Director during the year:—

- Joint Report on a visit to the first 9 miles of the Bartica-Potaro Road.
- Proposals for a "Pure-line padi Loan Scheme."
- Reports on proposed sites for a Government Stock Farm.
- Report on the possibilities of a Tomato Industry.
- Report on Agricultural Competitions.
- Progress Reports on Lodge Village Allotments.
- Monthly Progress Reports on East Demerara Division.
- Monthly Progress Reports on Co-operative Credit Banks.
- Progress Reports on District Activities.
- Report on Beterverwagting School Garden.

E. M. PETERKIN,
Agricultural Superintendent,
East Demerara.

January 14, 1933.

DEPARTMENT OF AGRICULTURE.

REPORT ON THE WEST DEMERARA DIVISION FOR THE
YEAR 1932.

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REPORT OF THE WEST DEMERARA DIVISION FOR THE YEAR 1932.

STAFF.

J. D. Gillespie, B.Sc. Agric. (Edin.)—Agricultural Superintendent.

GENERAL.

The year under review has seen large advances in agriculture generally in the district. Sugar has been in such a strong position as to be able to give cane-farmers a guaranteed price for their canes. Rice suffered a severe blow when the crop came in, but the formation of a Rice Marketing Board and Rice Sub-Associations should assist materially in stabilising prices.

2. Steady advances have been made towards determining and distributing the better varieties of cane and spreading the area under pure-line padi.

3. With the coming of District Administration new problems have been opened up and old ones revived, especially in the Canals Polder.

4. Abandoning the coastlands, extensive work has been done in connection with the establishment and maintenance of farms in the area of the Bartica-Potaro Road. In the Demerara River assistance has been afforded the British Guiana Fruit and Canning Company's project at Amsterdam.

5. The collection of the agricultural census for 1931 was carried out very minutely during the beginning of the year. The difficulty presented in obtaining any suitable means of transportation in the Demerara River is practically insurmountable. Agricultural education and Co-operative Credit Banks, competitions and extension work generally are considered elsewhere in the report under their respective heads.

6. Livestock problems, especially with pigs and cattle, have been important features of the district work.

CROP CONDITIONS.

Sugar.

7. The area returned as being under sugar in 1932 in this district was approximately 16,518 acres distributed over three estates situated on the West Bank, Demerara, and four estates on the West Coast: only four of the estates grind and make sugar.

8. As has been mentioned previously, 1932 was a good year. Owing to satisfactory weather conditions the crop was, generally speaking, a large one and yielded good returns while the price of the finished product has been remunerative. This is evidenced in the fact that the factories are receiving attention and improvements are being installed.

Rice.

9. The area under this crop continues to extend. It is, however, regrettable that this extension is carried out irrespective of the pasturage requirements of cattle in the district. There is a marked increase in the area under pure-line Demerara Creole but in this connection there are drawbacks. When the price of rice was fluctuating, farmers—who have now become their own agents, buyers, sellers and exporters—were disposing of their crop by bulk and they found that a bag of pure-line Blue Stick (because of the smallness of the grains) was a very compact parcel; Demerara Creole weighed per bag around 160-165 lbs. whereas they got a much better bargain with a heterogeneous mixture of barley rice, red rice, Jack Johnson (black rice), etc., and some farmers have actually reverted to these types. It is hoped, however, to instil into the minds of these growers that it is not only cheaper

to grow pure seed which gives a better yield, mills easier and with less breakage, etc., but the practice of mixing rice is one which cannot be afforded now-a-days by the average farmer.

Coffee.

10. After passing through very lean months from the beginning of 1931 until the middle of 1932, the price paid locally to the farmer for his coffee suddenly rose to about 11 cents per pound and it fluctuated between that mark and the original price of 4-6 cents for some time. It now appears to be settling around the 10 cents per lb. mark. This advance in price has been the signal for feverish activity in the Canals Polder area, which activity has only been temporarily suspended by the rains which came at the close of the period under review. When a cultivator is receiving around 10 cents per lb. for his product, he is willing to give some attention to his coffee trees, and weeding and general tidying up have been in evidence on a number of farms.

Cacao.

11. Except in isolated areas, very little attention is paid to the careful cultivation of this crop, and growers are not likely to be persuaded to return to the crop until the prospects are more encouraging than at the present time. The incidence of "Witch Broom" disease is also a deterrent to its extended cultivation. In a few estates on the Demerara River, however, systematic clearing and pruning and draining is being undertaken.

Tobacco.

12. In those areas where tobacco has been cultivated as a crop, the returns have been good. There are three farmers in the district who cultivate this crop intensively and their efforts are deserving of great praise. Although there is no soil in the district pre-eminently suited to the cultivation of this crop, it does well with careful cultivation and yields good returns to those farmers who take the trouble.

Pineapples.

13. Pineapples continue to thrive on the sandy soils of Amsterdam on the Demerara River and a canning factory has been built. A manurial trial has been laid down, full details of which are given in para. 25.

DISTRICT WORK.

Sugar.

14. The sugar-cane experiments which were carried out in 1931 in West Demerara, in conjunction with the Cane Agronomist, were continued this year. The types of experiments and the estates on which they were undertaken are enumerated below.

15. *Variety Experiments—Pln. Uitvlugt.*—Field 1 West:—This trial was continued as ratoons in 1932 and was reaped in September. The results are being published.

Field 10 Zeeburg:—This trial was laid down on April 28, 1931, and was reaped along with the other trials in September, 1932.

Field 13 E—This trial on flooded land was appointed on July 28-29, 1932, and consists of 8 replications each of 11 varieties, among which are D. 602/22, D. 625 (as control), D. 4/28, D. 15/28, D. 13/28, D. 24/28, D. 3/28, D. 11/28, D. 10/28, D. 9/28, and D. 23/28. These are seedlings raised at the Sophia Experiment Station and when visited during the last part of 1932 some looked extremely well.

16. *Manurial Experiments—Pln. Uitvlugt.*—Field No. 75 Zeeburg—This trial consisting of limestone and burnt lime was laid down, or rather the dressings were

applied on April 30-31, 1931, and the first crop was reaped in September, 1932; burnt lime and ground limestone were applied at 1, 2 and 5 tons per acre. When this crop was reaped, besides samples being taken and sent to Georgetown for analysis, sample punt loads were also ground at the factory of Pln. Uitvlugt.

Field 37 E. Uitvlugt.—One of the "Bookers Imperial Chemical Industries" trials was put down during the latter part of 1932 although the manures are not to be applied until January, 1933.

Field 94 Met-en-Meerzorg.—The second of Bookers' "I.C.I." trials is on this field. The field was planted on November 5, 1932, and the manures—sulphate of ammonia and Sulphate of Potash—were applied (the latter at a flat rate of $1\frac{1}{2}$ cwt. per acre and the former at 2, 4, 6 and 8 cwt. per acre) on December 20, 1932.

17. *Manurial Experiments—Pln. Leonora.*—Field No. 21 Groenveldt.—This trial was reaped during 1932.

The results of these experiments are now being analysed and will be published, in the near future, in a separate bulletin.

Rice.

18. Two notable events have taken place during 1932 with a view of initiating a programme of pure seed distribution in this district. These are (1) the distribution of 100 bags of pure-line Demerara Creole seed padi and (2) the growing of 7 acres of pure-line Demerara Creole.

19. *Distribution of Seed Padi.*—As indicated in the Divisional Report for 1931, a padi barn was established in two disused cells of the Fellowship Police Station and it was from this barn that the seed padi was distributed this year. The seed was sold at \$1.80 per bag of 143 lbs. and this weight was slightly increased towards the end of the planting season to allow for the ravages of insects and rats.

20. *7-acre block of pure seed padi.*—At Vreed-en-Hoop an area of 7 acres was obtained for the purpose of growing Demerara Creole. To ensure the purity of the seed, this block was entirely under the charge of the Agricultural Superintendent of the District. The 7 acres yielded 177 bags of uncleaned padi (approximately 25 bags per acre), which have been stored in the Fellowship padi barn and will be winnowed and sold or loaned out to farmers during 1933. It is proposed, with the help of the District Commissioner to sell some of this padi through the local authorities who will be held responsible for the collection of the price of the padi. The disadvantage in the distance of transportation from the land to Fellowship padi barn (approximately $7\frac{1}{2}$ miles) was overcome by the assistance of the Public Works Department.

21. *Rice Associations.*—With the fall in the price of rice a meeting was held at Windsor Forest to discuss ways and means of alleviating the distress, and from this arose the possibility of the formation of a Rice Association in Georgetown with sub-Associations in the various districts. At a meeting held for the purpose of distributing the prizes in the rice competitions referred to in para. 36, an opportunity was afforded of discussing the establishment of these associations in this district.

Coffee.

22. An attempt was made at the beginning of 1932 to establish a coffee pruning demonstration plot at the head of No. 2 Canal. At that time the price of the product was still very low and it was easy to find a farmer willing to put a block of mature coffee at the disposal of the Agricultural Superintendent. For the purposes of the demonstration, an area was chosen of uniform plants, which were divided into twelve sections each of which was again sub-divided into four divisions, each of one row of coffee. The plan was to prune one section each month throughout the year, and thus demonstrate the most beneficial period for this work; and, secondly, to prune—in

the divisions—one row of light pruning, *i.e.*, removal of superfluous growth only, one row of medium pruning (removal of all tertiary and 50 per cent. of the secondary shoots) and one row of heavy pruning, *i.e.*, removal of all secondary shoots as is practised with good results in certain areas of the North West District. This plot was continued until February when funds gave out and it had to be discontinued. It is hoped, however, that at some future date an opportunity will arise to carry through this plan as it is calculated to be of immense educational value to the farmers in that area.

Cacao.

23. There is one estate in the Canals Polder where cacao is cultivated with care and the intention to succeed with the crop. On this estate, permission was granted to lay out a pruning and general rejuvenation demonstration as was planned in the case of coffee. The trees chosen were in an unkempt condition, overgrown with "water-shoots," burdened down with old dead branches, and covered in "Witch Broom" disease. As a beginning, a careful note was made of each tree, its condition and appearance. Next, the crop was reaped and the yield of each individual tree noted—it was found that there were only two trees which gave over 25 pods each. The average number of pods per tree was 5-6. Before pruning was started, however, it was found that the demonstration could not be carried out owing to lack of funds.

Tobacco.

24. Work on this crop during the preceding year was concentrated on the distribution of the seeds of known and proved varieties to selected farmers, and the giving of advice where necessary. It is unfortunate that the demand for tobacco leaf is impartial as to whether the leaf be unripe, ripe, or over-ripe, cured or uncured, good or bad, as no incentive is given to produce a really high quality leaf.

Pineapples.

25. In April, 1932, it was agreed to lay out a manurial trial on an area of approximately $1\frac{1}{2}$ acres of the young pineapple plants on the British Guiana Fruit Canning Company's grant at Amsterdam, Demerara River. The area was divided off into plots containing approximately 380 plants and these were dressed with a mixture of sulphate of ammonia, sulphate of potash and superphosphate in varying proportions. There were in all 5 replications of each of the following:—

A 11 lbs. Sulphate of Ammonia.		9 lbs. Sulphate of Potash.		11 lbs. Superphosphate per plot.	
B 22	" "	18	" "	22	" "
C 33	" "	27	" "	33	" "
D 22	" "	18	" "	11	" "
E 22	" "	9	" "	22	" "
F Control—No Manure.					

26. This trial was visited again in July and although it could be readily seen that the plants had benefited from the application as compared with those plants in the rest of the field, there was no appreciable difference as between the various treatments. This is considered to be due to the sandy nature of the soil which, when dressed with 31-93 lbs. of a soluble manure per plot, allowed this to be leached away into the drainage water. Results might have been different had the application been made up of soluble and insoluble manures and applied in smaller dressings.

27. During the earlier part of the year a visit was paid to the concessions by His Excellency the Governor accompanied by Mr. F. A. Stockdale, Colonial Agricultural Adviser to the Secretary of State for the Colonies, and the Director of Agriculture. The Agricultural Superintendent visited the concessions in July and the Entomologist visited in April and again in November in connection with insects reported to be attacking the plants.

AGRICULTURAL EDUCATION.

General.

28. As in previous years the Co-operative Credit Banks have served as nuclei for the broadcast of advice and leaflets on agricultural problems.

29. The Juvenile Agricultural Club which was inaugurated in 1931 continued to flourish until a compulsory carpentry class was included in the curriculum of the two schools from which the members of the Club were recruited. As each boy was given two half days each week in the carpentry class, it left little time and energy in the week for voluntary work at the garden. Until gardening is included in the school curriculum no real progress will be made. The Den Amstel Juvenile Agricultural Club, which was mentioned in the Divisional Report of 1931 continues to plod along despite all obstacles. A sufficiently strong club to be active in the dry season and during holidays has not yet been formed, but the members show progress and the activities of the club are of great interest to the villagers and parents of the boys.

30. The departmental stand at the British Guiana Workers' League Exhibition held in October gave an opportunity for displaying produce from the district and also gave the farmers a chance of benefiting educationally.

31. There was a large attendance of farmers from all parts of the district at the rice threshing machine demonstration which took place in the Botanic Gardens in May. Many growers were impressed with the work of the machines and orders might have resulted had a demonstration been arranged while the departmental block of pure-line Demerara Creole padi was being reaped. Unfortunately, this could not be fitted in with the East Coast programme.

Competitions.

32. In West Demerara District the following agricultural competitions were held during 1932 :

(1) For the best block of transplanted pure-line seed padi (autumn crop) on the West Coast between Vreed-en-Hoop and Hague, the area to be not less than half an acre.

1st prize	...	...	\$ 15
2nd prize	...	...	10
3rd prize	...	...	5

(2) For the best miscellaneous farm on the West Bank, between La Grange and Stanleytown, the area to be not less than half an acre in extent.

1st prize	...	...	\$ 15
2nd prize	...	...	10
3rd prize	...	...	5

Prior to inaugurating these competitions every effort was made to make them as widely known as possible through the agency of placards and distribution of leaflets. The rules governing the competitions were also fully explained.

33. *Padi Competition.*—The points on which this competition was judged were as follows :—

General layout and preparation of nurseries and beds	...	30 points.
Uniformity of type and freedom from redgrains	...	20 "
Freedom from weeds, pests and diseases...	...	10 "
Yield ...	...	40 "

The padi had to be threshed and not bull mashed and the padi reaped was to be sold as far as possible for seed purposes.

34. The entries for this competition were considerably restricted due undoubtedly to the fact that during 1931 failure to comply with the conditions disqualified the entrants whilst in 1930 only a portion of the prize money was awarded. The

judging was, therefore, confined to those farmers who had purchased pure-line Demerara Creole padi from the Fellowship padi barn and who had rice lands between Vreed-en-Hoop and Pln. Hague, West Coast, Demerara. On account of two competitors obtaining approximately the same percentages, it was necessary to slightly amend the allocations of the prizes—the first prize being reduced and two second prizes awarded. The prize-winners were as follows :—

Housil, Pln. Blankenburg	...	1st prize—(\$10 00)
J. Hicks, Den Amstel	...	2nd prize—(\$ 7 50)
Jaikrie, Pln. Hague	...	2nd prize—(\$ 7 50)
Joe Joe, Pln. Windsor Forest	...	3rd prize—(\$ 5 00)

35. *Miscellaneous Farm Competition.*—The points on which this competition was judged were as follows :—

Drainage	...	30 points.
General layout and state of cultivation	...	30 "
Condition of crops, freedom from pests and diseases	...	20 "
Livestock (including poultry)	...	20 "

The competition was confined to the West Bank, Demerara River, between Stanleytown and La Grange, (*i.e.*, in the Canals Polder area). The three best and most progressive farms in the area were awarded prizes as follows :—

Khoon Khoon, Sans Souci, No. 1 Canal	...	1st prize—(\$15)
Ganess, Anna Catherine, No. 1 Canal	...	2nd prize—(\$10)
Abdul Karim, No. 2 Canal (North)	...	3rd prize—(\$ 5)

36. The Elected Members for this district, Hon. A. V. Crane and Dr. J. B. Singh, kindly consented to award the prizes to their respective winners in the West Bank and West Coast areas.

CO-OPERATIVE CREDIT BANKS.

37. The six Co-operative Credit Banks in this district, of which the Superintendent is Charman, continue to function and their positions in their respective areas are becoming more consolidated and their presence of more use to the community. It certainly is unfortunate that the highly intensive agricultural area comprised by the three Government estates of Plus, Windsor Forest, La Jalousie and Hague are served only by a Bank such as the Den Amstel-Fellowship Bank, which has paid no dividends for the last five years. It must be said for the banks concerned that even though much trouble ensues in attempting to collect long outstanding loans, yet every application for a loan is considered and if the security is good and money is available, the loan is made. Most difficulty is experienced in impressing on committees the necessity, irregardless of the security offered, of restricting the area served by the bank.

38. The working of the Banks can be seen from the following table :—

Name of Bank.	Loans made or renewed. 1932.	Outstanding loans and Interest collected. 1932.
Vergenoegen	... \$ 338 78	\$ 466 05
No. 1 Canal (Bagotville)	... 650 64	1,007 56
Good Intent and Sisters	... 852 20	866 28
Den Amstel-Fellowship	... 814 09	1,341 86
Leguan	... 408 86	670 51
Vreed-en-Hoop	... 282 00	663 69

39. There is one point which I particularly wish to emphasise and that is the unnecessary trouble that borrowers have to undergo before a loan can be issued from the various Co-operative Credit Banks. As is generally known, promissory notes are received in exchange for such loans, and in consequence, a signature has to be

attested and the loan paid to the borrower in the presence of a Justice of the Peace when the borrower cannot write. One bank, *i.e.*, Good Intent and Sisters, is two miles distant from the nearest resident Justice of the Peace and should he be absent from his home, it means that the borrower and the Chairman, who always pays loans personally, are put to considerable inconvenience. It should be pointed out that the previous Chairman of the banks were Justices of the Peace and it is only hoped that, in future, the same policy will be adopted for the present Chairman.

CENSUS RETURNS.

40. The collection of the agricultural census returns now forms part of the duties of the Agricultural Superintendent. The district has been divided into the following areas:—

- West Coast, Demerara (from Vreed-en-Hoop to Parika).
- West Bank, Demerara and the Canals Polder.
- Upper Demerara River (from Georgetown to Wismar, both banks).
- Island of Leguan.
- East Bank, Essequibo.
- Parika to Bartica.

41. In the 1932 census collected, a departure was made from preceding years, namely, that where it had been the custom to fill in—under the sugar section—only the number of acres reaped, has now been altered to show: (1) The area under sugar, *i.e.*, sugar area reaped, area turned over, area under-fallow, and any area temporarily abandoned, or, in other words, the area capable of being put under sugar; and (2) In a separate space the actual area reaped. This has been done in order that the returns for each estate might tally with the acreage returns supplied by the Boeraserie Commissioners' Report.

MISCELLANEOUS.

42. The Bartica-Potaro road was included in the district during the year and periodic visits have been paid to encourage the farmers there, and to investigate pests. In April a visit was paid in conjunction with the Conservator of Forests and the Agricultural Superintendent, East Demerara, with regard to the couch grass pest and the cultivations were inspected as far as the 9 mile limit. The farmers in this area are more optimistic than seriously inclined towards agriculture—with but few exceptions. There is one farmer really making a success of his holding and endeavouring to grow those crops suited to the soil in the vicinity, *e.g.*, groundnuts, etc.

43. During the year a visit was also paid to the area surrounding Garraway's Stream on the Potaro River and a report submitted on the agricultural possibilities there.

44. The following reports were submitted to the Director during the year:—
- Report on position of Leguan Bank.
 - Suggested amendments to Bank Ordinance.
 - Reports on working of six Co-operative Credit Banks each month.
 - Results of tobacco trials (two reports).
 - Tobacco plots existing 1932 and programme.
 - Two reports on intended trials with coffee and cacao, 1932.
 - Précis of experiments with tobacco, coffee and cacao.
 - Report on British Guiana Fruit and Canning Co.'s concession.
 - Rice experiments.
 - Report on Bartica-Potaro Road.
 - Census returns.
 - Results of Farmers' Competitions.

JAMES D. GILLESPIE,
Agricultural Superintendent, West Demerara.

February 13, 1933.

DEPARTMENT OF AGRICULTURE.

REPORT OF THE ESSEQUIBO DIVISION FOR THE YEAR 1932.

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REPORT OF THE ESSEQUIBO DIVISION FOR THE YEAR 1932.

STAFF.

- A. deK. Frampton, C.D.A. —Agricultural Superintendent.
A. A. Abraham —Assistant Superintendent.
J. E. Wilson (to March, 1932) —Assistant Agricultural Instructor, Wakenaam.
A. W. Sears (April, 1932, to date)—Agricultural Instructor, Wakenaam.

GENERAL.

The chief work during the year has been in connection with the Bush Lot Land Settlement and the Anna Regina Estates. The cultivated area of the estates (after the completion of the development works) was greatly increased. All the padi lands were re-allocated immediately preceding the autumn crop, when the new land was brought under cultivation. The irrigation and drainage system was also enlarged and perfected to operate the increased cultivated area.

2. A new-up-to-date rice milling plant was put down, during the year, in place of the old rice mill. A new padi cleaning machine was also erected for use with the autumn crop. Trials were also made with a power threshing machine.

3. Tours have been made throughout the district by the Agricultural Superintendent and the Assistant Superintendent, special attention being paid to pure-line seed padi distribution. The special campaign for the propagation and distribution of pure-line seed padi which was inaugurated last year was continued. The system has proved very successful, great improvement in the quality of the padi grown having been obtained throughout the district. It is now estimated that there are at least 5,000 acres of padi cultivation, under pure-line seed on the coast, and 1,000 acres in Wakenaam Island. By arrangements which have been made to continue seed distribution, the entire padi growing area of the district should be under pure-line seed by the autumn crop of 1933. The system of private seed farms in the district has now been definitely established, and future supply of seeds for distribution should be assured.

4. The death of Mr. J. E. Wilson, Agricultural Instructor, Wakenaam, occurred during March, Mr. A. W. Sears, from the Rice Grading Office, Georgetown, was appointed to the vacancy and assumed his duties in April.

5. Two crops of padi were grown on the coast this year; the water supply being excellent for both the spring and the autumn crops. This enabled the distribution of two lots of pure-line seed. All pure-line plots yielded very well indeed particularly in Wakenaam where yields of 28-36 bags of 140 lb. per acre were obtained. The wide distribution of the pure-line seed padi has not only resulted in greater returns per acre, but the quality of the rice milled has also improved.

6. Arrangements were made for the entire Anna Regina Estates padi crop to be purchased and stored in the estate bond preparatory to milling with the new rice mill plant.

7. A variety experiment with padi was conducted with the autumn crop on the Henrietta Experiment Station, the varieties tried were Blue Stick, Demerara Creole and No. 79. Apart from this experiment observation plots were laid down with graded seed padi, three grades being used. Further trials with graded seed are to be made both on Henrietta on a special plot laid out in the district, the object being to try and improve the type of grain. In some parts of the district, this grain is very small and consequently when milled into rice and sold by the gallon, it takes a greater bulk of rice to fill the measure than if a larger grain were obtained. The seed is being graded by a hand machine supplied by the Colonial Development Fund.

8. Pure-line Blue Stick padi was also grown on the Henrietta Station for distribution to seed farmers in the district; 184 bags were harvested; the bulk of this padi was all booked in advance. Single head selections were also made for the spring crop sowing.

9. I continued to act as Chairman of the Local Credit Banks in the district, regular monthly meetings have been held during the year.

CROP CONDITIONS.

Rice.

10. The year cannot be said to have been a good one for farmers in the district. Prices of all commodities fell to lower levels than recorded before and, with the exception of coffee which rose in price during October, the low level of prices was maintained. The chief crop of the district is padi. Two very good crops were reaped during the year, but the low prices obtaining for super rice in the export markets reflected on the prices paid to the grower.

11. For the 1932 spring crop padi was purchased at \$1.32 per bag of 155 lbs. this represented a drop in price of 14 cents on the 1931 autumn crop. Planting of the 1932 autumn crop was carried out extensively, however, increases in the acreage being recorded in Wakenaam, on the Anna Regina Estates and in the Pomeroy New Road areas. The autumn crop throughout the district was an excellent one, but unfortunately prices fell this time to \$1 per bag of 155 lbs.—a drop of 32 cents per bag on the spring crop. Slightly higher prices were paid in Wakenaam at the commencement of the reaping owing to the early harvest, and competition among buyers to receive new crop padi for milling. These higher prices were, however, not maintained. In the Pomeroy area only 75 cents per bag was offered and it is likely that the acreage in that area will decrease as a result. The price of \$1 per bag on the principal milling estates was fixed during October. This caused some dissatisfaction amongst farmers, but the price had to be accepted as it was seen that better could not be obtained. On many estates the farmers have been told that \$1 per bag paid may be looked upon as an advance payment only, and in the event of rice export prices improving a bonus will be paid on each bag of padi.

12. The trend of the market has been most discouraging to farmers this year and in many cases no profit will result on the autumn crop at all, and where a small acreage only is worked a loss will occur. On some estates the farmers have refused to make preparations for the next crop and are relying on obtaining a drop seed crop. This will be very detrimental to the quality of the padi, and the areas so affected are being carefully watched with a view to making provision for seed distribution prior to the autumn crop next year. In some areas farmers are talking of leaving their cultivation and going to sugar planting districts. The areas so affected are the ones having no rice mills close at hand, and to sell their padi, farmers have to transport it long distances, and at the low price offered, it cannot pay to cultivate the crop. If prices do not improve later it is feared that land will go out of padi cultivation in some areas. It is most unfortunate that prices should have dropped to such low levels at a time when the cultivation has not only largely increased, but improved, especially with reference to the quality of the padi grown.

Ground Provisions and Vegetables.

13. Provision cultivation has also suffered a set-back during the year, owing to the low prices realised for produce. Difficulties in connection with transport prevented the shipping of provisions to Georgetown, especially in the case of plantains. Large new areas of provision farms were started during the early part of the year, but these were abandoned later owing to the poor prices for produce; bunches of plantains which previously sold for 24 cents to 36 cents were being sold for 6 cents to 8 cents. Farmers eventually allowed the bunches to rot on their farms, only reaping sufficient for their own use. These poor prices were partly brought about by

the large amount exposed for sale in the provision farm districts, and partly by low prices realised by farmers on their padi crop, and consequently the scarcity of money in circulation.

14. An improvement was recorded in the sale of sweet potato and black eye peas during the year and efforts are being made to get farmers to take up the cultivation of these crops more extensively. Gardening is not carried out extensively, produce for local consumption only is grown.

RICE.

15. *Agricultural Experiments—Henrietta Experimental Station.*—The experiments with rice at the Henrietta Experiment Station were continued during the year. A variety experiment with three local varieties was laid down.

16. (a) *Variety Experiment.*—The following varieties were tested in four latin squares, each square containing 9 plots of 1/80th of an acre each :—

No. 79 ; Blue Stick and Demerara Creole.

17. From the statistical analysis of the results of the trial it was shown that there was significant differences between varieties. The mean yields given in bags (of 140 lbs.) per acre are shown below :—

Variety.	Bags per acre.	Difference.
No. 79	34.5	...
Blue Stick	30.8	3.7
Demerara Creole	30.1	.7
Standard Error of Difference		.574

No. 79 gave 3.7 bags per acre more than Blue Stick and is, therefore, significantly better than Blue Stick and Demerara Creole. Although Blue Stick gave a slightly higher yield than Demerara Creole, the difference is not significant.

18. (b) *Machinery Trials.*—In this connection a seed drill and weeding machine were received, through the Colonial Development Fund, from Messrs. Cabrini and Mocchi, Italy. These machines are the same type as those used in Italy. A preliminary trial was made with the seed drill but owing to the heavy rains that set in the machine could not work efficiently. Further trials are to be made with the 1933 spring crop and it is hoped to incorporate the use of the power threshing machine, winnowing machine and hand-winnowing machine obtained from Messrs. Bon Accord Engineering Co., Aberdeen, through a grant from the Colonial Development Fund. If the use of these machines is practicable, it should be possible on some of the estates to reduce the costs of cultivation considerably.

19. Investigation into means by which the costs of padi cultivation may be reduced were also started during the year.

20. *District Work.*—Owing to lack of funds only one crop for extension purposes—the autumn crop—was grown on the Henrietta Station. Seed padi for distribution with autumn crop sowing was obtained from special seed farms previously established on the estates and in the district with the 1932 spring crop. This seed was purchased from the seed farmers as required and sold direct to other farmers. This system worked very well indeed, and supplied all seed requirements for the autumn crop sowing ; 173 bags of padi were distributed in this manner. The system of private seed farms started last year worked very well.

21. The acreage of the seed farms was calculated so that the area planted would produce sufficient seed for the total estate area. In the case of an estate of 250 acres, 80 bags of seed would be needed and to produce this amount it was estimated that 5 acres was necessary. On certain estates, therefore, 5 acres of good land was selected which was being worked by efficient farmers. Sufficient pure-line seed from the Henrietta Station was then given out to these farmers to plant the five acres. This five acres was then worked as an estate private seed farm and the

proprietor had an area which would produce sufficient seed for his whole estate. The farms were regularly inspected and instructions given in roguing, etc., the proprietor being advised as to the state of the cultivation. In some cases the proprietors when purchasing this padi paid extra money per bag as an encouragement to the seed farmers. This system was found to be very satisfactory indeed, and a vast improvement in the quality of padi throughout the district has resulted. These seed farmers are encouraged through the estate proprietor to take a fresh supply of seed each year, with the spring or autumn crops, so that the quality does not deteriorate. Instructions have also been given in making single head selections. This method has not proved very successful as farmers are not inclined to go to this trouble without receiving higher prices for their padi.

22. Private seed farms were instituted in areas where the estate system does not obtain. The seed is distributed to selected farmers, whilst others in the area are encouraged to obtain their supplies of seed from this source. Where orders are received for padi which cannot be supplied from the estate seed supply system, cash is taken in advance. The seed padi is then purchased from these private seed farms (extra being paid per bag above the market rate if the quality is really good) and distributed to fulfil orders which otherwise could not be supplied. This system was practised with the autumn crop harvest 1931 and spring crop 1932; about 150 bags being purchased and distributed.

23. There are one or two large rice millers who have no estates and their source of padi is from farmers growing padi on Government land (Pomeroon and New Ground areas). Seed is sold to these millers from seed farms or Henrietta stocks. The millers then distribute this seed to farmers from whom they purchase padi. This system has just been started in the Charity-Pomeroon area and is likely to prove successful. It is also carried out in Wakenaam Island with success. If seed cannot be supplied to the millers through the Henrietta Station, then a seed farmer's name is given to the miller and he purchases his supplies through that farmer.

24. Direct sale to farmers was also practised, particularly in Wakenaam where there are large areas owned by farmers themselves independent of any estate. From this system seed farms have been started and farmers are encouraged to purchase from this source. These areas are inspected by the Agricultural Instructor and if the quality is not maintained then farmers are encouraged to purchase supplies from the Henrietta Station. The Wakenaam areas have to be very carefully watched as they only plant one crop per year, the autumn crop. The spring crop is a Lameira and drop seed crop.

25. The foregoing systems are all practised in Wakenaam with success, the quality of the padi there having improved in the past twelve months beyond expectations. Arrangements have been made for maintaining pure seed supplies and the balance of supply and demand of seed for each season is carefully watched as seed carried forward from one crop to the next is not popular in the district. Apart from the actual controlled distribution of seed arriving out of the system described there has been a lot of pure-line seed distributed from one estate to another.

26. The greatest improvement in the quality of padi has been seen in Wakenaam Island where the area under padi has increased very largely during the past year. The quality of padi previously grown on the Island was very poor, and our efforts have been most encouraging indeed.

27. The seed padi competitions of 1931 gave publicity to the movement, and farmers, when they saw the increased yield obtained from pure-line seed and the good sample reaped, were keen to obtain supplies. These supplies were given out through the agency of private seed farms, and some farmers purchased seed from estates on the coast. The rice millers also were very keen on improving the strain of seed padi, and assisted in this campaign by purchasing the better class padi and

keeping it for distribution to farmers and for seed purposes. In this way, and by a further supply being shipped from the Henrietta Station, the quality of the padi sown for the autumn crop was greatly improved. In fact during this harvest only a very small amount of poor padi was noticed. Practically the whole padi acreage of the Island is now under a good strain, though it will take a little time to eliminate the mixed types entirely.

28. A number of soil samples from every type of padi soil in the district, were taken for the Chemist-Ecologist. Yield figures for the areas sampled are being obtained.

29. *Rice Grading*.—Rice grading on the Essequibo Coast for miller exporters was continued during the year. The conditions were modified somewhat, in that samples only were taken whilst the actual grading and issuing of certificates were carried out in Georgetown.

OTHER CROPS.

30. *Green Manures and Cover Crops*.—Crops grown for supply are:—Bengal beans, pigeon peas, black eye peas and various kinds of garden crops. Yams will now be included and a trial will be made with English potatoes with the coming planting season.

31. Farmers in the district do not as yet appreciate the value of cover crops, but demonstrations will be given during the next planting season of the use of these crops particularly in connection with gardening at the Bush Lot Land Settlement. Farmers in Wakenaam took up the use of cover crops on their provision farms, last year and by the use of black eye peas as a cover, reaped profitable crops. The benefits derived were two-fold, a saving in weeding, and cash from the sale of the peas reaped.

32. Owing to the depression in the provision market, most of the farms were abandoned and the practise of growing a money cover crop was discontinued. With improved prices, farms are being taken up again and special attention will be paid to the growing of these cover crops. The growing of pigeon peas is also being encouraged with a view to local dhall manufacture. This has not yet met with much success.

33. Several varieties will be grown on the sand reef plots including the Indian pigeon pea (used for making dhall). If provision farming had been maintained at its previous high level it was hoped to encourage farmers to establish pigeon peas as a boundary fence from which cuttings would be taken for green manuring.

34. *Onions*.—Special attention has been paid to onion cultivation this year and a fairly large scale demonstration has been laid out at the Bush Lot Settlement. Two systems of manuring are being tried:—

(a) Pen manure.

(b) Sulphate of Ammonia.

When these plots are harvested results will show which is the cheapest fertiliser to apply, and experiments with each will follow.

Onions are the most remunerative garden crops to grow, and it is hoped to get farmers in the district to take up this cultivation more seriously. Difficulty with this crop lies in the fact that in an average year the arrival of the seed coincides with the padi harvest, and it is difficult to get farmers to pay close attention to both crops during this season.

36. *Tomatoes*.—Tomatoes are also an important and remunerative garden crop for local sale, and plots have been laid out of different varieties with a view of obtaining supplies of seed for distribution.

37. *Pineapples*.—The collection of pineapple varieties is being continued. These have not fruited well and much of the fruit set was damaged by red ants and rats before it could be harvested. A fresh site for the extension of suckers has been chosen on the Bush Lot sand reef.

38. *Sweet Potatoes*.—The Barbados sweet potato cuttings were extended during the year and distribution of the cuttings commenced. The latter have proved very successful, especially in Wakenaam Island.

COMPETITIONS.

39. The following gricultural competitions were held during 1932 :—

Essequibo Coast—Padi Competition.—For the best block of transplanted pure-line seed padi (autumu crop) on the Essequibo Coast, the area to be not less than half an acre.

Wakenaam-Island—Padi competition.—For the best block of transplanted pure-line seed padi (autumn crop) on Wakenaam Island, the area to be not less than half an acre.

Essequibo Coast—Miscellaneous Farm competition.—For the best miscellaneous farm from Affiance to Richmond (including Anna Regina Estates), the area to be not less than half an acre.

40. Pcents were awarded as follows :—

- (a) For the padi competitions, Essequibo Coast and Wakenaam Island :
- | | |
|---|------------|
| General Layout, and preparation of nurseries and beds ... | 30 points. |
| Uniformity of type and freedom from red grains .. | 20 „ |
| Freedom from weeds, pests and diseases ... | 10 „ |
| Yield | 40 „ |
- (b) For the miscellaneous farm, Affiance to Richmond :
- | | |
|---|------|
| Drainage | 30 „ |
| General layout and state of cultivation... | 30 „ |
| Condition of crops, freedom from pests and diseases ... | 20 „ |
| Livestock (including poultry) ... | 20 „ |

41. *Padi competitions—Essequibo Coast*.—The conditions under which the padi competitions took place were practically the same as in 1931. Notwithstanding this, however, greater enthusiasm was shown, inasmuch as the competitions were further extended this year. In 1931 entries were received from all parts of the coast, Supenaam to Devonshire Castle whilst this year farmers as far as Better Hope competed; the number of entrants received was 144, an increase of 74 over the previous year.

42. Pure-line seed padi, purchased from the Henrietta Station, was grown on all those estates on which the competitive plots were situated. Special mention should be made of the excellent cultivation of padi grow on the estates of Hibernia and Fairfield where, hitherto, any type of padi was cultivated. Proprietor and tenants alike exerted every effort to maintain, during this crop, a stand of pure-line seed with the result that the yields on these estates have risen to 33 bags per acre.

43. All the estates were inspected regularly throughout the growing season and special instructions were given to new entrants in nursery work, roguing of volunteer types and the preparation of seed beds.

The final prize-winners were as follows :—

- 1st prize (\$15)—Golli, Pln. Hibernia.
 2nd „ (\$10)—Balwant, Pln. Airy Hall.
 3rd „ (\$ 5)—J. C. Laurie, Pln. Better Hope.

44. *Padi Competition—Wakenaam Island.*—The usual procedure in regard to making the competition known was adopted again this year through the aid of placards, leaflets and personal talks by the Agricultural Officers when on tour. Special mention should be made of the efforts of the Agricultural Instructor who in his regular visits of inspection gave much assistance in regard to the preparation of the seed nurseries, and the importance of roguing in order to keep the competitive plots in pure line seed strain (demonstrations in this respect being given). These instructions as was the case last year were carefully carried out.

45. The competition this year was keenly contested, and it is very encouraging to record that there has also been an increase in the number of entrants received, 47 farmers registered their names as compared with 23 in 1931.

The prize-winners were as follows :—

- 1st prize (\$15)—Ramjohn, Plantation Good Success.
- 2nd „ (\$10)—Chas. Loyd, Pln. Bremen.
- 3rd „ (\$ 5)—H. M. Henry, Pln. Amersfort.

46. *Miscellaneous Farms—Essequibo Coast.*—The entries for the miscellaneous farm competition were all withdrawn owing to the fact of the low price of farm produce, in view of which the farmers complained that they were unable to maintain the plots in the form required for competition purposes.

47. The Department has to express its appreciation and thanks to the Elected Member of the District, Hon. E. F. Fredericks, for kindly consenting to award the prizes to the various prize-winners in the above competitions.

ANNA REGINA ESTATES.

Staff.

- H. C. Jaisingh—Field Overseer, Anna Regina.
- A. S. Khan —Book-keeper and Cashier, Anna Regina.
- N. Ally —Assistant Book-keeper, Anna Regina.

These estates comprise the following sections :—

- 1. Bush Lot Land Settlement.
- 2. Anna Regina (two sections).
- 3. Henrietta.
- 4. Richmond (two sections).
- 5. La Belle Alliance (two sections).

General.

48. There has been an increase in the number of tenants working padi land on the estates, although there was insufficient land to accommodate all those who applied, due to the fact that the existing tenants have all increased their cultivation, in fact many tenants were unable to secure as much land as they required. There has been an increase in the padi land worked by the West Indians, especially amongst large families who have taken up in some cases 8 to 9 acres between them, where they previously only worked 3-4. Even artisans such as carpenters and engineers now work padi land on the estate, if not extensively, then sufficient to supply their own requirements.

49. Two crops of padi were grown on the estate this year. The spring crop yielded well, but harvesting conditions were bad due to early spring rains.

50. This crop was not purchased by the estate, outside buyers coming in and taking off the crop from the tenants under agreement with the estate office so that the collection of revenue proceeded normally.

The benefits of the re-allocation of the padi fields (previously referred to) were seen in the yields obtained with the autumn crop. This was particularly noticeable

on some of the old padi land. Each tenant was able to control his own irrigation and drainage and this saved a lot of disputes as to water rights at planting time. Further by having all the cultivation located in one spot tenants paid more careful attention to it, and practically no neglected beds were noticed. Hitherto where a farmer's cultivation was scattered, proper attention was seldom paid to any of his beds, and considerable time was taken in travelling from one section to another, more especially at planting time. Some of the beds on the old land which previously gave only 16-18 bags when held by two or more tenants, gave 20-24 bags when worked by farmers who controlled the irrigation and drainage. The re-allocation was not appreciated by farmers at all when commenced, many asking to keep their scattered cultivation. Results have proved to them the desirability of having their cultivation in one place, and general satisfaction of the benefits derived have been since expressed by many of the tenants.

51. The new padi land yielded very well indeed with few exceptions, results obtained in many cases being far in excess of that expected. This was due to the manner in which the beds were "broken down" and the fact that planting was not allowed until the beds had plenty of time to "weather" and "settle." Newly broken land generally gives very poor yields and in some cases no crop is reaped. The quality of padi harvested was very good. Harvesting conditions were ideal and all padi was stored in excellent condition.

52. The entire crop was purchased by the estate at \$1 per bag and stored previous to milling. This payment was treated as an advance and should a profit result on the milling a bonus will be paid.

Unemployment Relief Works.

53. The development works commenced in July, 1931, were continued during the year. Large new areas, particulars of which are given below, were made available for cultivation and cattle-grazing. This work was completed during the month of October.

54. Apart from the Bush Lot Land Settlement the following tables show the increases in acreage brought under cultivation and pasture grazing :—

PADI LOTS.		AUTUMN CROP, 1931.	
Anna Regina	...	147	acres.
Henrietta	...	79	"
Richmond	...	155	"
La Belle Alliance	...	190	"
		571	acres.

PADI LOTS.		AUTUMN CROP, 1932.	
Anna Regina	...	250	acres.
Henrietta	...	193	"
Richmond	...	374	"
La Belle Alliance	...	220	"
		1,037	acres.

AUTUMN 1930.		PROVISION LOTS AVAILABLE (AREAS).	
Anna Regina	...	60	acres.

AUTUMN 1932.		PROVISION LOTS AVAILABLE (AREAS).	
Anna Regina	...	300	acres.

55. Owing to the state of the provision and plantain market, this land was not taken up as anticipated and even old farm areas were abandoned. This is very much to be regretted, especially from the point of view of estate revenue.

AUTUMN 1930.		CATTLE-GRAZING AREAS.	
Anna Regina	...	Nil	
Richmond	...	150	acres.

AUTUMN 1932.		CATTLE-GRAZING AREAS.	
Anna Regina	...	213	acres.
Richmond	...	150	" (reconditioned).
La Belle Alliance	...	125	" (reconditioned)
La Belle Alliance	...	325	" (re-wired and reconditioned).

56. Apart from the increasing acreages of wired pasture, improvements were effected by cutting out heavy bush, and rebuilding the night pens. The result of

these improvements has been seen in the extra number of cattle agisted. Attendant upon the foregoing development works improvements were also effected to the drainage and irrigation of the estate lands.

57. Abandoned trenches were cleaned, culverts repaired, and plank weirs put in to raise the water level, in order to be able to irrigate certain high padi areas.

58. The total estate area to be drained was greatly improved by the inclusion of La Belle Alliance section, but even with the heavy rains experienced the water was so controlled that little flooding except of some of the very low padi land was experienced and losses of crop by this cause were very small. A new sea-sluice has now been put in at La Belle Alliance which will perfect the drainage system of the properties and improve the conditions for padi cultivation on the low lands.

59. Improvements to the drainage of the dwelling areas have also been effected, by repairing defective outlets and the digging of trenches. In this connection a special grazing area for "house" cattle (*i.e.*, milch cows) has been laid out which will prevent damage being done to trenches and parapets during the wet season. By these improvements in drainage of the dwelling areas, new sites are being taken up by tenants for erecting their own houses.

Machinery Trials.

60. *Rice Mill*.—A complete up-to-date milling plant was erected at Anna Regina during the year. This mill was obtained from Messrs. Lewis C. Grant, Fife, Scotland, through a grant from the Colonial Development Fund. The work on the mill was completed early in May and preliminary milling trials were then conducted. Some very good samples of white rice were made, though the padi used was not first class. The plant, driven by a 30 H.P. Petter Oil Engine, will be used for milling the autumn crop padi. As some parboiled rice will be made, tanks for soaking and steaming the padi were constructed locally. The output of the mill plant is estimated at 60 bags of clean white rice per day.

61. Apart from the above plant the following machines were also received:—

1. Power aspirating and grain dressing machine.
2. Power threshing machine.

62. *Power aspirating machine*.—This is an improved grain cleaning machine which removes all dirt, light grains, sticks, straw, etc., from a parcel of hand-threshed padi. The machine is driven by a 5 H.P. Petter Oil Engine. The plant was set up in the factory yard with the commencement of the padi harvest.

63. This machine has done very good work indeed. By the use of this plant it has been possible to store a great deal of padi very much quicker, than if waiting for the farmers to clean it by hand methods. At present the machine is fed by porters and the cleaned padi is discharged on to the floor. Work could be greatly accelerated if an elevator were attached to feed the machine and a system of bag spouts constructed for collection of the clean grain. These points are being investigated with a view to improvements being effected prior to the next harvest. The working costs of the machine are low and it is possible to clean a bag of padi for 1 cent still leaving a margin after paying expenses for running depreciation.

64. The capacity of the plant averages 40 bags of clean padi per hour. With the improvements suggested above it should be possible to increase this to 50 bags per hour, or between 400 to 500 bags per day. With a big crop of padi, such as reaped on the estate properties, the value of a machine of this type cannot be over-estimated.

65. *Threshing Machine*.—The machine supplied was a single dressing power thresher driven by a 5 H.P. Petter Oil Engine.

66. Trials were made with this unit during the spring crop harvest 1932. Weather conditions were, however, unfavourable and little use could be made of the thresher with that crop. Weather conditions for the autumn crop harvest were ideal, but the farmers were not keen on using the machine. Only one small scale demonstration was made. The reason for this was because use of the machine entailed transporting the padi on the straw to the machine. The machine being heavy, can only work on the dams, and to bring padi to it would mean transporting bundles 50-100 rods and crossing a trench. Labour for this was so expensive that it was more economic to beat out the padi *in situ*. The weather conditions, as explained, were ideal, all rice beds being absolutely dry. The padi could therefore be hand-threshed anywhere in the beds, little transportation being necessary. Owing to the large cultivation on the estate the labour supply was somewhat limited and for any extra work, such as transportation, high rates were demanded. Were the thresher more easy to transport, and if it could be put into the padi beds, every farmer on the estate would want to use it. All farmers admitted that it does excellent work, but the question of transportation was the drawback. It may be possible to place the unit in a specially constructed punt, in this way the machine could be transported to the bed heads, and more use would be made of it, at any rate for the half of the bed nearest the thresher. This will be tried with the 1933 spring crop harvest.

MISCELLANEOUS.

67. *Visitors.*—His Excellency the Governor, accompanied by Mr. F. A. Stockdale, Agricultural Adviser to the Secretary of State for the Colonies, and the Director and Deputy Director of Agriculture visited the Anna Regina properties and the Bush Lot Land Settlement in March. An inspection of Unemployment Relief Works was also made.

68. The Colonial Secretary visited Anna Regina and the Bush Lot Settlement during March.

69. The Officer Administering the Government visited the Anna Regina properties and the Bush Lot Settlement in September. His Excellency also saw a demonstration carried out with the new rice milling plant, and the aspirating machine.

70. The Director and Deputy Director paid frequent visits to the estate properties during the year. The District Commissioner paid several visits to the properties.

71. The Director of Public Works visited the properties on two occasions in connection with the rice mill plant and the Unemployment Relief Works.

72. The Commissioner of Lands and Mines and the Deputy Director visited Anna Regina in July, inspecting all the abandoned and uncultivated land on the estate.

73. The control management of the estate properties and the Bush Lot Settlement was handed over to the District Commissioner on November 22 prior to the departure on leave of the Agricultural Superintendent.

74. *Reports.*—The following were the most important reports submitted to the Director during the year ;—

Monthly reports—Henrietta Station and Essequibo District.

Monthly reports on Co-operative Credit Banks.

Weekly reports on the Bush Lot Settlers' cultivations.

Report on agricultural competitions.

Results of experiments carried out on the Henrietta Station.

Report on padi prices at commencement of autumn harvest—arising out of complaints by estate and Bush Lot Settlement tenants.

75. In conclusion I wish to express my appreciation of the support and loyalty given by the staff during the year who have worked very hard to bring the year's work to a successful conclusion, often working continually overtime without hesitation or demur.

A. DEK. FRAMPTON,
Agricultural Superintendent,
Essequibo.

February 13, 1933.

DEPARTMENT OF AGRICULTURE.

REPORT OF THE NORTH WEST DIVISION FOR THE YEAR 1932.

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REPORT OF THE NORTH WEST DIVISION FOR THE YEAR 1932.

STAFF.

E. Beckett, F.L.S.—Agricultural Superintendent.
L. E. McKinnon —Foreman.

GENERAL.

Visits were paid by the Agricultural Superintendent to all the farms in the Aruka, Koriabo, Barima, Imbotero, Kaituma, various grants on numerous creeks and areas under cultivation in the Moruca river.

2. The total miles travelled by boat was 4,877 as against 3,826 in 1931 and 4,226 in 1930.

3. The rainfall was extremely heavy, the total for the year being 111 inches and 71 parts, as against 95 inches and 78 parts in 1931. In May there were only two days without rain, the same number in June and five in July. The monthly precipitation was under :—

January	...	8·092	July	...	12·047
February	...	4·059	August	...	7·064
March	...	4·037	September	...	7·088
April	...	9·030	October	...	4·053
May	...	15·081	November	...	3·056
June	...	11·031	December	...	21·033

4. The need of a drier or driers for coffee is very urgent. At the present moment there is only one drier in the district, that of Messrs. Garnett & Co., Ltd., and this is not large enough to "handle" outside crops. There are seven hullers in the district while each farmer has a pulper usually made locally. The portable Bentall coffee pulper at the Station was tried on various holdings. On the whole it proved a success having the advantage of separating the seed from the skin and so saving much labour by doing away with the tedious operation of sifting with wire mesh frames. The type used was, however, on the small side; nevertheless owners of small plantations were interested in its working and one at least has expressed his intention, as soon as he can afford it, of superseding his locally made pulper with a Bentall.

5. During the heavy rains farmers suffered considerably in transporting their crops to the steamer both at Kumacka and Morawhanna. The need of a shed over the Kumacka Stelling is a pressing one—such a shed would also serve as a protection in preserving the stelling. At Morawhanna a sheltered stelling would be a great help.

CROP CONDITIONS.

Coffee.

6. The price for Liberian coffee was very poor throughout the year, with the exception of occasional increases for a very short period to $8\frac{1}{2}$ and even 12 cents, towards the ending of the year. The prices obtained for provisions were also not particularly attractive. The price for corn was fair. The areas under ground provisions have decreased for various reasons. The acreage under coffee has increased compared with the figures for 1931; in cases where large areas were being cultivated many farmers found it good business to reduce their areas and deal with the crop with the aid of their families and with as little hired labour as possible.

All farmers have worked extremely hard. In spite of the depression there has been a shortage of labour throughout the year, especially so during the coffee harvest seasons.

Coconuts.

7. In the Moruca there are some very fine areas under coconuts including two or three at the mouth of the Moruca river. In the Barima, Aruka and Koriabo, coconuts are planted on the pegasse dams of the "grants," though pegasse soils are quite unsuitable for this palm, nevertheless a crop or two is frequently reaped and as the palm dies another is put out—with the view more of consolidating the dams than with the expectation of anything of a crop.

Citrus.

8. The lime seedlings distributed free of charge to various farmers have made, on the whole, a good start both on pegasse and hill. The lime factory at Mabaruma has taken off the crop in the district, but owing probably to the heavy rains the crop was a small one. Only distilled oil of limes and écuelled or hand-pressed oil was manufactured, owing to the fact that citric acid is now obtained synthetically.

9. During the year, 6,221 lime seedlings were distributed from the Hosororo station, of which 3,200 were sent to Georgetown, the remainder—3,021—being distributed in the district. The total area now under limes is 216 acres as against 125 in 1931.

Of budded limes 1,195 were distributed chiefly to Mr. H. Samson and Garnett & Co.

10. The cultivations of budded grapefruit and oranges are at present limited to the farmers on the Hosororo, Mabaruma and Wanaina range of hills. They have for the most part done well. There were 380 marsh grapefruit distributed during the year from the Hosororo Station. The demand for budded oranges and grapefruit will be met in March, 1933,—the plants budded in 1932 will then all be ready for distribution. The buds were obtained from Trinidad and consisted of Marsh grapefruit, Parson Brown, Valencia and Jaffa oranges.

Cacao.

11. Interest in cacao cultivation has been sustained during the year and several small cultivators are putting in a few trees to supply their own wants, whilst others, more ambitious, are aiming at eventually supplying the local demand. The largest individual acreage is 35 acres.

At one time a considerable amount of chocolate, made locally from raw cacao, used to be consumed. This appears to have been ousted somewhat by imported prepared cacao (other than confectionery); the imports for 1931 amounted to 122,175 lbs. valued at \$18,256; the imports of raw cacao were 9,624 lbs. valued at \$800. It would seem that there is room for the local article. The cacao trees in the North-West are free from "Witch Broom," and efforts are being made to keep this fungus out of the district.

HOSORORO EXPERIMENT STATION.

12. The red lateritic soil of the Hosororo hill, on which the Station stands, had formerly been settled upon by Aboriginal Indians, who, practising Milpa agriculture, denuded the hill of vegetation, planted cassava for a few years and then abandoned the area planted for some other site. The result has been that considerable erosion and elutriation has taken place and large areas of the Station consist of pure gravel, useless for agricultural purposes—hence in laying out areas for experiments, care has had to be taken to clear forest which is growing on a soil which does not consist of pure gravel with large outcrops of concretionary ironstone. This has resulted in the Station experiments presenting a somewhat "patchworked" appearance and makes inspection more lengthy than it would otherwise have been.

Citrus and Other Fruit.

13. The citrus areas have been well maintained throughout the year. A feature has been the marked progress made in the lime experiments, consisting of five acres of budded and seedling plants. Here the growth has been very rapid and a small crop was reaped during 1932, the plants being then only 3 years old. Seedlings yielded 5 barrels and the budded trees $17\frac{1}{2}$. Records of the yields of individual trees are being kept. Two budded lime plants died but there were no deaths amongst the seedlings. Budding operations were continued and efforts made to teach boys budding. The aboriginal Indian boy is not a success at this work but we still hope to train a few. The Negro and East Indian show great aptitude, but as in previous years, often just when they are useful, they either leave for what they consider better opportunities or have to be dismissed. During February budwood of Marsh grapefruit was received and during November budwood of oranges ("Parson Brown," "Jaffa" and "Valencia") and Marsh grapefruit. This last shipment was delayed in transit, which resulted in the drying up of many buds. At the end of December the following were growing satisfactorily and will be ready for distribution early in 1933.

Marsh grapefruit	...	...	326
Parson Brown orange	...	...	196
Valencia orange	...	...	112
Jaffa orange	...	...	168

There were also 866 splendid budded lime plants all ready for the field.

14. The lime seedlings were allowed, after the distribution of 6,221, to be over run with bush as the demand was then very limited and the upkeep would have been expensive.

15. At the close of the year, 2,000 sour orange stock were ready for budding in February, 1933, and 4,210 others growing satisfactorily, in various stages of growth, for budding at later periods. No stocks are utilized which are found to have malformed roots, or any other defect and only stocks that are found to be consistently making good growth are kept. All others are thrown out. This may be expensive but it is the only method that should be adopted.

The citrus trees planted at Hosororo started to flower during the year. One Marsh grapefruit planted in December, 1928, produced 90 fruits.

16. *Avocado Pears*.—The area under budded and grafted Avocado pears continues to make fair growth—with no disease attacking the plants. The varieties consist of "St. Anne's"; "Rivers"; "St. Clair"; "Pollock"; "Rudder" (all from Trinidad); "Munis"; "R. C. Lord"; "Martin-Sperry"—locally grafted.

Of the above "Rivers", "St. Clair", "Pollock", "Rudder", "R. C. Lord" and "Munis" produced fruit, being then a little over 3 years old. Some of the fruit were destroyed by Tiger cats—it is astonishing how inordinately fond of avocado pears they are.

Coffee.

17. Of the four "beds" under Liberian coffee on the pegasse flat at the foot hill, two beds will be topped, pruned, etc., while two beds will be treated according to current methods in the district. Careful data will be kept.

18. There will be a small crop from these trees during 1933. Efforts to establish a green cover crop on this worn or used up pegasse land, were unsuccessful. The following legumes were tried. *Dolichos* sp., *Canavalia* spp., black eye, bengal beans and other species of *Stizolobium*.

The question of green manures is referred to in paragraphs 27-30.

Poison Plants.

19. The experiments with the following poison plants have been continued—Black and White Haiari (*Lonchocarpus* spp.); Konami (*Clibadium surinamense*); Konoparu (*Euphorbia cotinoides*) and Dukanani (*Phyllanthus conami*) The Yaronalli (*Tephrosia toxicaria*) was discarded.

20. With respect to Haiari (*Lonchocarpus* spp.) those without shade definitely did better than those following the natural conditions of growing under shade. Further reference to this work is made under Wauna and Miscellaneous. Several cuttings and other material of Haiari were sent through the Department to Dr. Tattersfield of Rothamstead.

Minor Experiments.

21. *B. H. Mahogany*.—The Mahogany continues to do well with very little attention being given to the cultivation. Attacks from *Hypsipyla* sp. have not been so noticeable as in previous years.

22. *Black Pepper*.—The 12 plants of Black Pepper (*Piper nigrum*) planted in November, 1931, have with two exceptions, made very fair growth and are now on their permanent supports of *Gliricidia maculata*. The well-known variety "Balamcotta," which on arrival was a very puny plant appearing to have little chance of growing is now one of the best of the twelve.

23. *Oil Palms*.—The West African Oil Palms from seeds obtained from Nigeria and Essequibo, planted out on the pegasse at the hill foot are doing well. For further remarks on these palms see paragraph 37 under Wauna.

24. *Hydnocarpus and Neem*.—The three *Hydnocarpus anthelminta* planted on January 10, 1930, are growing well though little attention could be given them. The 12 small plants received during the year were severely attacked in the nursery by coushie ants (*Atta* sp.). They are to be planted out early next year, having recovered from the attacks. Of the three remaining Neem trees (*Azardirachta indica*) only one is making growth.

25. *Citronella*.—Seeds of Citronella were received from Ceylon during March this year and were sown at once. Those sown in open "beds" failed to germinate, while success attended the sowing of the seed in boxes in the nursery. The plants obtained were put in pegasse soil in May, being planted 4 ft. x 4 ft. The growth has been excellent; by October the plants had covered the ground and no weeding was necessary after this month.

If the economics of this plant prove to be as successful as the growth, we shall have found a permanent crop, other than Liberian coffee, which can be grown on pegasse. Until data as to yields, oils, etc., have been obtained, no plants are being distributed to farmers; they are, nevertheless, very interested in this experiment.

If Citronella will grow well under shade it might prove of value in the coffee fields in keeping down other grasses and help in the solution of one of the farmers' greatest problems, viz., the elimination of weeds in their coffee fields. Weeding is one of the heaviest items of expenditure in the district.

26. *Fodder Plants*.—The following fodder plants are being experimented with: Uba Cane, Elephant Grass (*Pennisetum* sp.), Wynne Grass (*Melinis minutiflora*), Guatemala Grass (*Tripsacum* sp.) and Demerara Primrose (*Asystasia gangetica*).

27. *Green Manuring*.—During the year, experiments with green manuring and legumes as cover crops, were carried out. Efforts at establishing legumes on the flat, pegasse hill foot at Hosororo (which area had been in cultivation under various permanent and other crops for four and twenty years and which can still produce fair crops of cassava and Liberian coffee) proved futile. The following legumes were tried; *Canavalia ensiformis*, *Canavalia gladiata*, *Stizolobium* spp. and

black-eye peas. Eventually, in February, a piece of land was secured on the right bank of the Aruka river (on a "grant" which was typical of the worn-out pegasse areas abandoned by farmers as useless for the cultivation of provision crops), with the view of rehabilitating it.

28. The legumes planted were: *Canavalia* sp., black-eye peas, bengal beans and *Stizolobium deeringianum*. The crops, by March, were growing splendidly, making at one time a brave show. The growth, with the exceptions of small isolated patches, was luxuriant and here and there extremely rampant. By the end of March, the whole area of about 2 acres was well-covered. During April, the cover was still beating the weeds. On May 7, all cover crops, with the exception of some areas of black-eye peas and one area of bengal beans, were being taken over by "sour" grass. During the latter end of April the black-eye peas were flowering and a pod or two could be seen. The *Canavalia* were also flowering. From May 9-21, the black-eye peas and *Canavalia* spp. were weeded and ploughed or trenched in.

In the meantime a control bed had been secured and weeded.

29. In June all legumes had been ploughed in and planting operations were started as follows:—

Bed 1.— <i>Canavalia ensiformis</i> .	Tannias and Yams.
<i>C. gladiata</i> .	Tannias and Yams.
Bengal beans.	Tannias.
<i>Stizolobium deeringianum</i> .	Tannias.
Black-eye peas.	Yams.
Bed 2.—Black-eye peas.	Tannias.
Bengal beans.	Yams.
Bed 3.—Black-eye peas throughout.	Eddoes, plantains and bananas.
Control bed: Plantains, bananas, yams, eddoes, tannias.	
<i>i.e.</i> Yams were planted with <i>Canavalia ensiformis</i> , black-eye peas, Bengal beans.	
Tannias were planted with <i>Canavalia gladiata</i> , <i>Stizolobium deeringianum</i> , Bengal beans.	
Eddoes were planted with black-eye peas.	
Bananas and plantains were planted with black-eye peas.	

With a larger area and a more plentiful supply of seed it would have been possible to replicate each of the green dressings with each crop under trial, this, however, could not be done under the circumstances. The cultivation was maintained, but at the end of the year it was patent that only poor returns, if any, might be anticipated. The tannias and eddoes will be ready for reaping at the beginning of 1933.

30. On the hill lands at Hosororo various legumes were tried out, the most successful cover crop proved to be *Canavalia ensiformis*. Unfortunately a large supply of seed was not available, and the supply which it was hoped to have obtained from the areas planted and successfully established on the hills, failed to produce seed, owing to very heavy rains preventing flowering and fruiting. Trinidad was unable to supply us with the large quantities of *Canavalia* seed we required.

31. *Weed Control Experiments*.—The most expensive item in coffee culture in this district is the control of weeds. During the year Messrs. Garnett & Co., Ltd., imported a weeding machine on the principle of a lawn mower.

We are not yet in a position to state whether this venture will prove a complete success or not. With regard to clean weeding of cultivations on the hill lands in this district, the harmful influence of weeds can be exaggerated (especially in the case of the sandy hills); sometimes they are of considerable help in checking the scouring effect caused by heavy downpours of rain, to which this district is peculiarly liable, and in preventing erosion.

On the flat pegasse areas, however, where coffee cultivation is carried on, if weeds could be successfully controlled by mechanical means or by cover crops, even at present prices, the cultivation of Liberian coffee should prove by no means repulsive.

32. *Cassava*.—Under existing conditions any economic plant for this district must be extremely hardy, its culture must be simple and understood by the labourers, and the yield must be good with the minimum attention as to culture. Bitter cassava answers to these requirements. There would seem a possibility for the extension of this crop and more prominent attention given to it by those who possess some capital. The plant will grow almost anywhere in the district. Even on the old used up pegasse areas, yields of 7,000 lbs. per acre are obtained from the better class of varieties.

Summary.

33. The following is a summary of permanent plants under experiment at the Hosororo Station.

Budded Grapefruit: Marsh.	...	213 plants.
" " Duncan	...	76 "
" " Florida Marsh	...	5 "
" " Pernambuco	...	2 "
" " Labuan	...	2 "
" " Walters	...	8 "
" Oranges: St. Michael's Blood	...	5 "
" " L. Summer	...	4 "
" " Jaffa	...	4 "
" " T. H. Late	...	8 "
" " Dancy Tangerine	...	16 "
" " L. G. Gong	...	10 "
" " Ruby	...	10 "
" " Parson Brown	...	10 "
" " Pineapple	...	10 "
" " Homosassa	...	3 "
" " Navel	...	14 "
" " Valencia	...	11 "
" " Satsuma	...	1 "
" " Grenada Orange	...	4 "
Ponderosa Lemon	...	4 "
W. I. Smooth-skinned (St. Lucia) Lime	...	24 "
Sicily Lemon	...	3 "
Succadee (Citron)	...	1 "
Hybird Lemon (Trinidad)	...	2 "
" Lime (Dominica)	...	2 "
Avocado Pears—		
St. Anne's (budded—Trinidad)	...	3 "
Rivers " "	...	4 "
St. Clair " "	...	4 "
Pollock " "	...	3 "
Rudder " "	...	6 "
Munis (local grafts, Botanic Gardens)	...	6 "
R. C. Lord (local grafts, Botanic Gardens)	...	9 "
Martin-Sperry (local grafts, Botanic Gardens)	...	1 "
Budded Limes	...	175 "
Seedling Limes	...	175 "
Old seedlings (growing in shade under balata and Para rubber)	...	200 "
'Historic' cacao (Rio Berbice) Type A.	...	22 "
Do. do. Type B.	...	15 "
Hydnocarpus anthelminta (large)	...	3 "
Do. do. (small)	...	12 "

B. H. Mahogany ...	...	...	430 plants.
Citronella ...	...	...	226 "
Grafted Nutmegs ...	...	...	5 "
Cinnamon ...	...	...	3 "
Tonka Beans ...	...	...	35 "
Insecticidal Plants ...	...	...	6 acres.
Coffee—Liberica ...	...	...	2 "
Coffee— other varieties ...	...	...	2½ "
Oil Palms (<i>Elaeis guineensis</i>) varieties :—			
No. 391 (Nigeria) ...	...	...	12 plants.
No. 480 " ...	...	...	6 "
No. 69 " ...	...	...	18 "
No. 321 " ...	...	...	9 "
No. 306 " ...	...	...	6 "
No. 332 " ...	...	...	3 "
Onderneeming (Essequibo) ...	...	...	258 "

WAUNA SUB-STATION.

34. The sandy soils of Wauna contain a small proportion of humus with a blanket of quartz sand covering for about 2 feet, a sub-soil of a reddish-coloured clay. Its value appears to be in direct proportion to the amount of humus it contains. When such soils approach purity and become areas of almost pure sand they are probably barren. There are several square miles of these sandy soils with varying amounts of humus apparently of the same type as Wauna, hence the experiments at this station assume great importance.

35. The coconut and oil palms (*Elaeis guineensis*) planted on this station have made a very good start, whilst the growth and health of the budded citrus has been markedly successful up to the present.

36. The haiari is of course on soil in which it delights and in the areas not under shade, rapid and vigorous growth has been made.

37. The two acres cleared for lime seedlings were planted instead with West African Oil palms, and a further area of one acre was cleared and put to this palm making a total of three acres. Owing to lack of funds, these palms, as also the coconuts, were weeded only once after planting, during the whole year; nevertheless they have done well.

38. The following is a summary of the permanent plants under experiment at the Station :—

Budded Grapefruit—Marsh ...	...	...	87 plants.
" Oranges—Parson Brown ...	...	...	32 "
" " —Dancy Tangerine ..	...	...	8 "
" " —Valencia ...	...	...	18 "
" " —Navel ...	...	...	9 "
" " —King Orange ...	...	...	5 "
Tangelos—Williams ...	...	...	2 "
" —Sunrise ...	...	...	2 "
" —Sampson ..	...	...	2 "
" —New ..	...	...	1 "
Succadee (citron) ...	...	...	2 "
Budded Limes ...	...	...	42 "
Oil Palms (<i>Elaeis guineensis</i>) :—			
No. 391 (Nigeria) ...	...	...	10 "
No. 321 " ...	...	...	5 "
No. 306 " ...	...	...	5 "

No. 480 (Nigeria)	...	...	...	10 plants.
No. 69	..	...	...	11 "
No. 332	..	...	...	9 "
Onderneeming (Essequibo)	...	...	...	86 "
Coconuts—Wakenaam, including 17 St. Lucia Dwarf Red.				3 acres.
Insecticidal plants	...	...	...	4 "

The one Tung Oil plant died during the year. With experiments in fodder grasses, the total area of land cleared now represents 17 acres.

COMPETITIONS.

39. Interests in the agricultural competitions this year was even more marked than in previous year. The final judging was carried out during October. The prizes were awarded for the best miscellaneous farm holding of not less than one acre in extent, in the following districts :—

Koriabo and Aruka.
Barima and Imbotero.

The farmers were judged on the following points :—

Produce grown and general rotation	...	20 points.
Varieties and quality	..	20 "
Freedom from weeds, pests and diseases	...	20 "
Livestock (including poultry)	...	20 "
Coffee	...	20 "

40. On the whole, the cultivations were up to standard. There had been an improvement in the Barima-Imbotero district, but the farms presented in the Aruka and Koriabo district, which in previous years always proved the better of the two, on this occasion were not so well cultivated as those in the Barima-Imbotero district put forward for the final judging.

41. The prize-winners were as under :—

ARUKA AND KORIABO DISTRICTS.

1st Prize	{ J. Bisnhat	...	\$10 00
	{ Abdul Ghanni	...	10 00
3rd Prize	{ C. Hercules	...	5 00
	{ J. Hill	...	5 00

BARIMA AND IMBOTERO DISTRICTS.

1st Prize	... C. Taylor	...	\$15 00
2nd Prize	{ J. Wong	...	7 50
	{ J. Jerome	...	7 50

Though there was less livestock shown, yet those that were produced for inspection were very promising.

CENSUS.

42. Table I. gives particulars of the acreage under agricultural crops in 1932. From a comparison of last year's figures it will be seen that there is a total increase in area of 173 acres. The most important increases have been :—

Coconuts	...	...	33 acres.
Cacao	...	...	5 "
Coffee	...	...	101 "
Lime	...	...	91 "
Other Budded Citrus Fruit	...	...	10 "

There was a total decrease in corn, ground provision and cassava of 76 acres; the details are shown separately this year, to show area in corn, the decrease has been under cassava and ground provisions.

DISTRICTS.	Sugar.	Rice.	Coconuts.	Rubber.	Cacao.	Coffee.	Limes Budded and Seedlings.	Other Budded Citrus Fruit.	Tobacco.	Nutmeg.	Corn.	Cassava.	Plantains, Bananas and Ground Provisions.	Total.
	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.
Arakaka ...	...	...	...	...	16	...	...	...	...	...	...	8	5	29
Aruka ...	...	10	19	200	20	878	56	...	...	3	142	109	86	1,523
Barima and Mora Passage ...	2	...	46	...	4	615	26	...	...	...	110	94	91	989
Hosororo Hills ...	...	...	1	...	1	...	4	8	...	...	20	12	7	53
Imbotero ...	...	3	21	...	...	142	2	...	...	...	64	46	45	323
Kaituma ...	...	...	...	...	...	30	...	...	...	...	2	6	2	39
Koriabo-Including Arukamai and Madadowa Hills ...	1	...	43	...	50	487	15	9	...	...	64	58	49	777
Mabaruma ...	...	...	3	...	13	15	114	1	1	...	3	18	2	170
Moruca ...	...	...	84	...	...	17	...	...	...	...	...	15	...	116
Waini ...	...	...	8	...	...	49	...	...	...	...	30	18	...	106
Total	3	13	225	200	104	2233	217	18	1	3	435	384	287	4,125
Increases	...	9	33	...	5	101	91	10	...	...	...	...	...	...
Decrease	1	...	...	...	...	...	...	...	...	...	76 acres			...

SEED AND PLANT DISTRIBUTION.

43. During 1932, the following distributions were made from the Stations:—

Coffee—Arabian	...	...	138 plants
Seedling Limes	...	...	6,221 plants*
Budded Limes	...	...	1,190 "
Budded Grapefruit (Marsh)	...	...	380 "
Avocado Pear (Seedlings)	...	...	32 "
" " (Budded)	...	...	42 cuttings
Papaw (Seedlings)	...	...	50 plants
Miscellaneous Fruit (Pomegranate, Sapodillas, Semitoo)	...	...	31 "
Banana—Gros Michel	...	...	200 suckers
Pineapple—Red Spanish	...	...	39 "
" —Montserrat	...	...	24 "
Fodders (Various)	...	...	61 cuttings
Cassava (Sticks)	...	...	12 bags
Sweet Potatoes (cuttings)	...	...	7 "
Cacao	...	...	308 plants
Boulanger	...	...	50 "
Cabbage	...	...	25 "
Miscellaneous (Cucumber, Ginger, Onion, Tobacco, Turmeric)...	...	...	2½ lbs. seed.

MISCELLANEOUS.

Block Survey Schemes.

44. The three blocks of land which were given out free of survey charges during 1931 as an encouragement to people in the district, have, with one exception, proved a success.

45. *Hosororo Block*.—This area is just at the back of the Experiment Station on the Hosororo range of hills and consists of 9 lots. Possession was given on September, 1931. Work was started immediately and during 1932 crops of

* 3,200 plants to Demerara County.

maize and small crops of tannias, pumpkins, cassava, yams, peas, mustard, tomatoes, cucumbers, etc., reaped. Also 373 budded grapefruit (Marsh) were planted out and are doing well, together with a little cacao and a few lime plants. One settler has already purchased a cow. The spirit that has prevailed has been fairly satisfactory and a certain amount of co-operation has existed. During 1932 five mora blocks were given out by the Acting Commissioner.

46. *Aruka Block*.—This is situated on the left bank of the Aruka river—the area surveyed being 309.63 acres, divided into 60 lots. Originally 46 applicants were settled on this pegasse area. Most of the lots have been empoldered, kokers put down, houses built and crops of corn, tannias, eddoes, peas, rice, etc., reaped. Very hard work was put in on this swamp land, but the settlers were severely hampered by the heavy weather conditions which were a feature of the year. During 1932, 13 more lots were given out by the Acting Commissioner.

47. *Morawhanna Block*.—The communal spirit seems to be absent here. The work was started but little or no progress has been made.

Nothing was done in this connexion in the Barima, but the farmers of that district are very keen on having allotments awarded them on terms similar to those granted the farmers on the Hosororo hill and the Aruka river.

Livestock.

48. Owing to the depression many farmers sold their pigs and poultry. Also, during the year on outlying farms hacka tigers and tiger cats appear to have made numerous marauding attacks on farmers' poultry. Many sold out or ate their fowls in despair of keeping large quantities.

The stock kept is, on the whole, of a very good class. Special mention must be made of the Freisian and Guernsey cattle kept by one farmer in the Aruka river.

The pigs, too, are mostly of a good Berkshire type.

Bees.

49. An attempt has been made to interest farmers in the keeping of bees. Talks have been given to the farmers, literature distributed, etc. One hive obtained by a prominent grower was destroyed by wild bees. At the Convent of Our Lady of Lourdes at Hosororo there are now four hives and honey of good quality is being obtained. The North West District should prove very suitable for bee-keeping, it is not so much that farmers are disinterested, but rather that they have a great deal of work to do and \$5, the price of a hive, is a consideration, with coffee, etc., at such low prices.

Diseases and Pests.

50. The endemic disease of coffee (*Sclerotium coffeicolum* (Stahel)) has again made its appearance felt and, in one or two instances, it had been found in portions of the district which had hitherto remained entirely free. Steps were taken to stop this inroad immediately. With coffee prices as they are we shall not be able to make any concerted efforts in getting rid of this fungus. Here and there, farmers, by burning diseased material and thus destroying sclerotia, have obtained some results.

51. *Wilt disease*.—A wilting of certain areas of coffee was very noticeable during this year—this attack was confined chiefly to the Koriabo and Aruka areas. One large plantation suffered very badly from an acute phase of wilt—several thousand trees being lost. Immediately, on inspecting diseased areas, the Agricultural Superintendent communicated with the Director of Agriculture and forwarded specimens to the Mycologist for his report and advice. The disease is still under observation and certain steps are being taken to combat it. There is, however, no cause for undue alarm. It may be remarked that areas which had been entirely neglected with regard to drainage and cultural operations generally, were those which were most extensively infested.

52. A fungus disease of the leaves (not yet identified) was noticed on Haiari growing at Wauna under shade. It has not appeared on the areas growing in the open. There has been noticed also a wilt of tomatoes grown from imported seed and also of boulangers, but plants from seeds of local fruit appear to be immune. On one holding, an old East Indian man—too old for very active work—grew from local seed about $\frac{1}{4}$ acre of tomatoes (intermixed with cucumbers) on pegasse soil and obtained a really excellent crop free from either wilt or fruit rot.

53. There has been no corn smut this year.

54. With regard to pests, one of the chief pests during the year was the "potato bug," on sweet potatoes in the Moruca river district. These appeared in vast numbers and did considerable damage. This attack was reported to me by Mr. Commissioner Long, on his return in March from one of his periodical visits to this district. I immediately reported to the Director of Agriculture and as soon as possible made a visit to the district. Specimens sent to the Entomologist were identified as *Spartacera batatas* F. Moruca produces excellent sweet potatoes, and should the attack occur again it is hoped to combat it by using calcium cyanide. Praiseworthy efforts were made by the farmers in decoying the pests and then destroying them by the bucketsful with fire.

55. There were very few attacks from the dipterous fly on Black Haiari at Hosororo—this pest was very noticeable and did much damage in previous years. The Haiari at Wauna has never been attacked by this pest.

56. Cockles (*Ligyra ebenus* deG.) made their appearance with the December rains and played havoc with the farmers' tannias. This pest, the farmers state, has never been known to have been so much in evidence during December, and its appearance at that time rather puts out of practice the efforts at evasion which had been recommended, and which up to now had appeared to be successful.

57. With regard to budded citrus plants the next persistent pest has been again the blade fly, already reported on in previous years. This fly does not appear to attack lime plants. Coushi ants, owing to suitable weather conditions, proved troublesome this year, but were kept in check whenever carbon bisulphide was available.

58. One other pest has given a great deal of trouble, and that is a black ant, with long wedge-shaped or triangular nests, which appeared on coffee trees. This pest known locally as 'mangrove' ant hampered picking operations very considerably.

OTHER WORK.

59. *School Garden*.—A satisfactory site has been fenced at the Hosororo Convent and a school garden established—practical work in the garden is supervised by the Officers of the Hosororo Station. Weekly lectures have been given to the children at the Hosororo Convent School by the Agricultural Superintendent. It is hoped to start a fortnightly course of lectures at the Anglican School at Morawhanna during 1933.

60. *Meteorological Work*.—On July 26, the Meteorological Observer arrived from Georgetown and put in position Wet and Dry bulb and maximum and minimum thermometers. Regular daily readings are recorded at 7 a.m., 1 p.m. and 6 p.m., the records being forwarded monthly to Head Office along with the rainfall records from Hosororo and Wauna Stations.

61. *Reports*.—The following were the most important reports submitted during the year :—

Census for 1931.

Report on prospects of Coffee.

Estimates.

Monthly Statements of Accounts.

Report on Tonka Beans.

Report on *Ligyrrus ebenus* deG.

Reports on Cover Crops and Green Manuring.

Report on "potato bug" (*Spartecera batatas* F.)

Monthly Progress Reports.

Report on Messrs. Garnett & Coy.'s Coffee Plantation.

Certain Statistics in connexion with Lime Factories.

Meteorological and Rainfall Returns.

Fortnightly Reports on Citrus.

Report on position of Citrus Nurseries.

Report on disease of Liberian Coffee.

Report on Field Competitions.

In official correspondence, 385 communications were dealt with.

62. *Visitors*.—Apart from a few farmers the visitors to the Station included :—the Deputy Director and the Government Entomologist; the Commissioner, Mr. A. W. B. Long; the Botanist and Mycologist; Mr. O. Bennett of Messrs. Garnett & Coy.; Father Begnigno, a Spanish Priest, and Sisters Teresa and Michael.

EDGAR BECKETT,

Agricultural Superintendent,
North West District.

January 14, 1933.

DEPARTMENT OF AGRICULTURE.

REPORT OF THE RICE EXPERIMENT STATION, GEORGETOWN
AND PLANT BREEDER FOR THE YEAR 1932.

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REPORT OF THE RICE EXPERIMENT STATION, GEORGETOWN, AND
PLANT BREEDER FOR THE YEAR 1932.

STAFF.

L. E. W. Codd, M.Sc.—Plant Breeder.
J. Indrobeharry —Agricultural Assistant.

GENERAL.

1. My appointment as Plant Breeder was made possible through a Colonial Development Fund Grant and duty was assumed on September 20, 1931. The Rice Experiment Station was placed under my control as from January 1, 1932.

2. *Station Buildings.*—At the beginning of the year a grant of \$1,000 was obtained in order to provide an office for myself and accommodation for the machines which were purchased with the assistance of the Colonial Development Fund. A partition was placed across the office occupied by the Agricultural Superintendent for East Demerara and part of the roof was raised. Additions were made to the eastern end of the existing buildings to accommodate the following machines :

Mechanical thresher fitted with 5 H.P. Petter engine.
Winnowing machine, propelled by hand,
Seed-selecting machine.

3. *Padi grown during Autumn Crop 1931.*—Padi grown on the Experiment Station is handed over to the Agricultural Superintendent, East Demerara, for storage and distribution. A record of the padi grown (apart from Progeny Rows and hybrids) is shown in Table I below :—

TABLE I.
PADI PRODUCED ON THE EXPERIMENT STATION DURING 1932.

Variety	Lbs. of padi.	
Demerara Creole	...	33,526
No. 79	...	14,881
H. 7 ...	...	710
A. 16.34	...	735
Blue Stick	...	342
Kalyaman	...	717
Ramcajara	...	840
Kristna Kata Kulu	...	482
Lead Rice	...	439
Hope ...	...	486
Total	...	53,158

The area of the Rice Experiment Station is approximately 20 acres, so the yield obtained corresponds to about 20 bags of 140 lbs. padi per acre.

4. *Cover Crops for Rice Fields.*—Attempts have been made to discover a leguminous cover crop which will grow satisfactorily in rice fields after the crop has been harvested. Only one variety, a species of *Vigna* found growing wild about the Station, shows any signs of success.

PURE LINE SELECTION.

5. 116 single plant selections from 55 varieties were grown in observation plots. The Progeny Row yields were headed by the variety *Ramcajara*, which possesses a medium length, coarse-grain. This variety was followed by four small-grain types, namely, *McKenzie Small*, *Kristna Kata Kulu*, *C 14.31* and

Ak Kullu, followed by the two popular varieties *No. 79* and *Demerara Creole*. Unfortunately, the short-grained types have a lower commercial value than the medium and long-grained types.

6. Varieties obtained from more or less temperate countries such as America and Japan do not adapt themselves to local conditions and continue to give poor yields. The Carolina types possess many desirable features, such as high quality of grain, large panicle, strong straw and short growth period, and for these reasons have been included in crosses with local varieties. The chief disadvantage is their poor tillering power, and, in order to overcome this defect, an experiment will be conducted in which closer spacings (say, 4" x 4" or 4" x 6") will be tested.

EXPERIMENTAL WORK.

7. The results of experiments conducted during 1932 have already appeared in bulletin form, and will be briefly summarised here. All experiments are laid down in such a form that the yields lend themselves to statistical analysis. Plots are 1/80th. acre in area (unless otherwise stated), and all plots are surrounded by strips to avoid border effects.

Variety Trials.

8. Tables II. and III. indicate the results of the two variety trials conducted during 1932.

TABLE II.
RESULTS OF VARIETY TRIAL NO. 1.

Variety.	Origin.	Grain type.	Padi lbs. per acre.	Remarks.
No. 79	... Local	... Medium	... 3,108	Fairly strong straw.
Ramcajara	... Local	... Medium	... 3,024	Weak straw.
Kalyaman	... Trinidad	... Seta Patna	... 3,024	Early maturing.
H. 7	... Local	... Seta Patna	... 2,996	Fairly strong straw.
Demerara Creole	... Local	... Seta Patna	... 2,926	Weak straw.
A. 16.34	... Burma	... Seta Patna	... 2,716	Weak straw. Matures very late.

Significant Difference ($P=0.05$)=156 lbs. per acre.
 "Z" Value for Varieties =0.573
 "Z" Value for $P=0.05$ =0.4648
 "Z" Value for $P=0.01$ =0.6540

TABLE III.
RESULTS OF VARIETY TRIAL No. 2.

Variety.	Origin.	Grain Type.	Padi lbs. per acre.
No. 79	... Local	... Medium	... 3,416
Kristna Kata Kulu	... India	... Short and fine	... 3,346
Lead Rice	... Local	... Short and thick	... 3,290
Hope	... Local	... Short and thick	... 3,276

Significant Difference ($P=0.05$)=218 lbs. per acre.
 "Z" Value for Varieties =0.4603
 "Z" Value for $P=0.05$ =0.5950

9. In both trials, the variety *No. 79* headed the list, and in 1932, sufficient seed of this variety was available for some distributions to be made. This variety is recommended, not on yield alone, but also on its good milling quality and its strong straw.

10. In the second trial, three "barley" (short, coarse-grained) rices were tried out against *No. 79* and gave good yields. This type of rice is not in great demand locally, but if expansion is to take place on other markets it may become necessary to extend these types.

Spacing Experiment.

11. An experiment was conducted with the variety *Demerara Creole* to determine the optimum density of planting. The results indicated that 8 x 8 inch spacing was the best, while 4 and 6 plants per clump gave a definitely higher yield than 2 plants per clump.

12. The number of ^{ripe} panicles and the weight of grain per clump naturally increased with the increase in space available. Panicle length appeared to be very susceptible to crowding and was reduced by close spacing and by increasing the number of plants per clump.

Machinery Trials.

13. (a.) *Seed-selecting Machine Experiments.*—Three experiments with *Demerara Creole* and No. 79 were conducted to test the value of separating seed padi into light, medium and heavy grains, and it was found that the heavy grains gave no increase in yield over the light or medium grains.

14. (b.) *Threshing and Winnowing Trials.*—A threshing machine fitted with 5 H.P. Petter engine and a winnowing machine were obtained for the Experiment Station with the assistance of Colonial Development Fund Grant. These machines, together with a small thresher with 1½ H.P. engine, were demonstrated to farmers and the running costs and capacity output were estimated for purposes of comparison with the primitive methods of threshing and winnowing by hand.

15. The results are summarised below in Tables IV and V:—

TABLE IV.
ECONOMICS OF THRESHING.

	Output per 8 hour day. Bags of 140 lbs.	Labour cost and running expenses.	Cost per bag includ- ing depreciation.
By hand	4.5	\$ 0 50	\$ 0 11
Small Thresher	49	3 08	0 08
Large Thresher	90	4 11	0 08

The large machine performs the additional functions of winnowing and delivering the padi into bags.

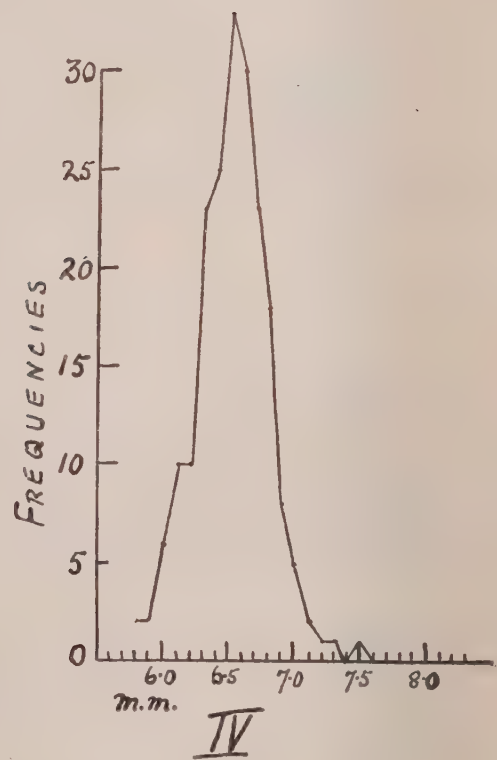
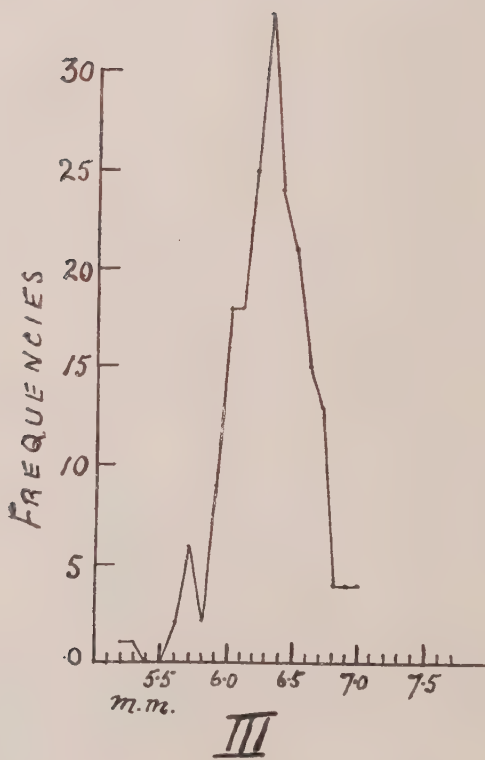
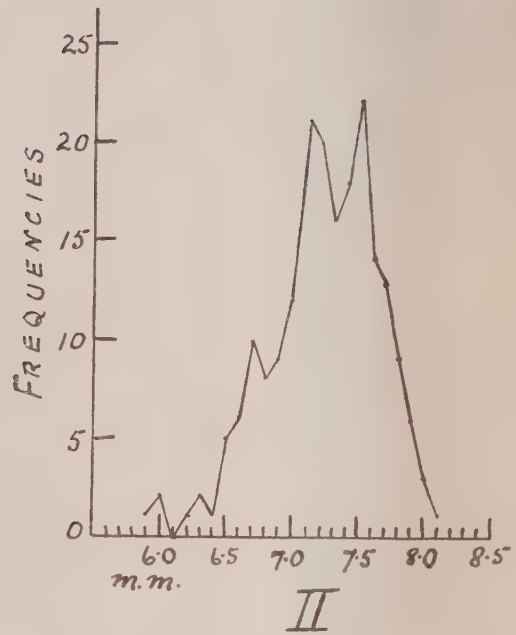
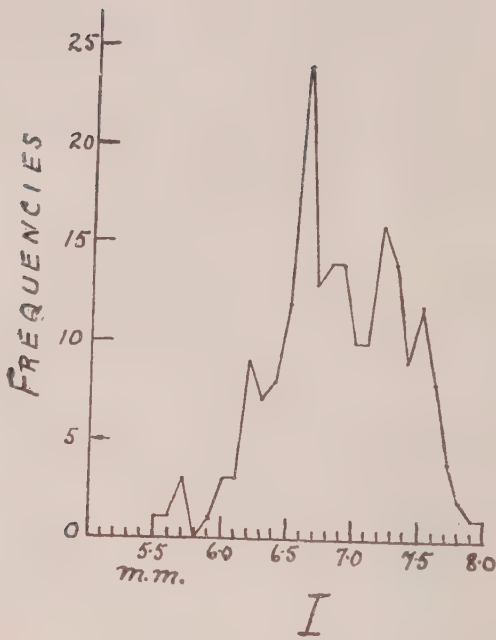
TABLE V.
ECONOMICS OF WINNOWING.

	Output.	Labour expenses.	Cost per bag of clean padi.
Wind-winnowing	21	\$ 1 04	\$ 0 05
Machine-winnowing	48	1 52	0 03.2

Dimensional Characteristics of Padi.

16. The degree of purity of a variety as regards length and breadth of grain cannot readily be ascertained by eye, and some trouble has been taken to devise a method of estimating purity mathematically. The method is described in some detail in *Rice Bulletin* No. 1 and only a brief summary will be given here.

17. 200 husked grains are measured and frequency diagrams are plotted of the length and breadth. If a uniform diagram with one peak is obtained, the variety may be regarded as fairly pure, but the presence of two peaks immediately suggests that there are at least two strains present which differ slightly in their dimensional characteristics. Figs. I-VIII. are the frequency diagrams obtained in this way.



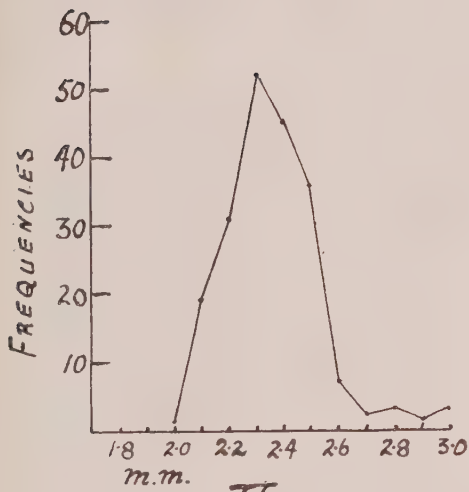
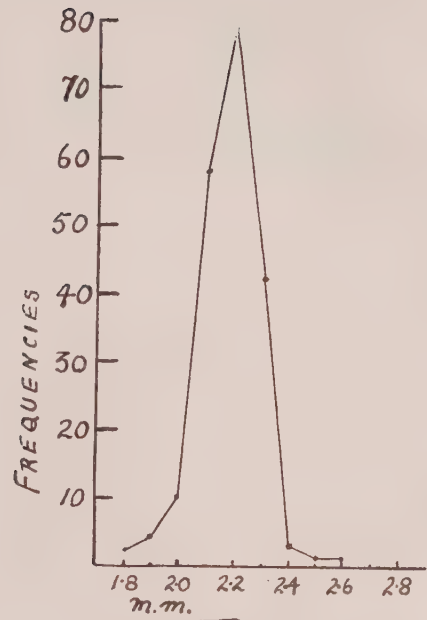
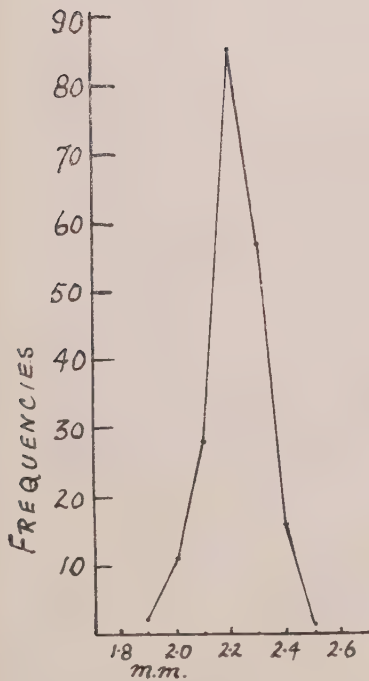
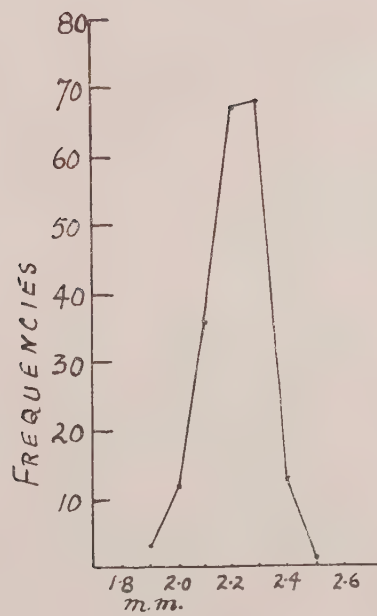
Frequency Diagrams, Lengths of 200 Husked Grains.

Fig. I.—Peasants' Padi

Fig. II.—Demerara Creole.

Fig. III.—Blue Stick.

Fig. IV.—No. 79.

VVIVIIVIII

Frequency Diagrams, Breadths of 200 Husked Grains.

Fig. V.—Peasants' Padi.

Fig. VI.—Demerara Creole.

Fig. VII.—Blue Stick.

Fig. VIII.—No. 79.

The "peasants' padi" was an extremely mixed sample collected at La Penitence and was included to demonstrate extreme variation. It will be seen that *No. 79* and *Blue Stick* give fairly uniform diagrams whereas *Demerara Creole* exhibits two peaks, one at 7.1 mm. and one at 7.5 mm.

18. A check on this measure of purity is provided by the "co-efficient of variation" represented by "C" in Table VI. Table VI also shows the mean lengths and breadths of some of the more important varieties.

TABLE VI.
DIMENSIONS OF SEVERAL VARIETIES OF PADI.

Variety.	LENGTH.				BREADTH.				Length Breadth Ratio.
	Mean Length mm.	Std. Devn.	Std. Error.	C.	Mean Breadth mm.	Std. Devn.	Std. Error.	C.	
Kalyaman	7.37	.377	.027	4.96	2.23	.085	.006	3.81	3.30
H 7	7.27	.365	.026	5.02	2.19	.095	.007	4.34	3.32
Demerara Creole	7.24	.417	.029	5.76	2.18	.109	.008	5.00	3.32
Carolina Edith	7.09	.407	.029	5.74	2.51	.102	.007	4.06	2.82
Peasants' Padi	6.88	.495	.035	7.20	2.86	.172	.012	7.29	—
Peru	6.74	.306	.022	4.54	2.58	.093	.007	3.60	2.61
A 16.34	6.72	.356	.025	5.30	2.26	.088	.006	3.59	2.97
Ramcajara	6.52	.285	.020	4.37	2.37	.100	.007	4.22	2.33
No. 79	6.51	.274	.019	4.21	2.21	.109	.008	4.93	2.95
Blue Stick	6.30	.306	.022	4.86	2.22	.103	.007	4.64	2.90
Hope	5.52	.208	.015	3.77	2.58	.099	.007	3.87	2.14
Kristna Kata Kulu	5.47	.240	.017	4.39	2.25	.097	.007	4.43	2.43

From the Length · Breadth ratio it will be seen that the Demerara rices are somewhat longer and thinner than the majority of rices produced in other parts of the world.

Effect of Age on the Viability of Padi.

19. The effect of age on the germinative capacity of seed padi is of some importance to farmers. In areas where one crop per year is grown, the padi is reaped in October and must then be stored for sowing about the following May—a storage period of about seven months. The other extreme is found in places where the land is cropped twice per year and where seed padi from one crop may therefore be required almost immediately for sowing the following crop. Investigations by Lord⁽¹⁾ show that varieties which take a long period to mature require a correspondingly long resting period and that the seed will therefore fail to germinate immediately after reaping. On the other hand, quick growing varieties may require no resting period whatever.

20. A similar investigation has been conducted at the Experiment Station with the variety *No. 79*. The seed used in this germination trial was harvested on April 20 and 21, 1932, at which time the two mechanical threshers already referred to were being tried out. As these machines tend to break the grain to a small extent, it was decided to include padi from these machines in this trial so as to compare its germination with hand-threshed padi over an extended period.

21. Germination tests were carried out every fortnight, beginning on April 27 and Fig. IX. represents the results obtained, each reading on the graph representing the mean percentage germination of 4 samples of 50 grains.

(1) Lord, L. and Fernando, W. N.: Tropical Agriculturalist, 1931: VII:—329-332.

EFFECT OF AGE ON THE VIABILITY OF PADI

Fortnightly Tests from April 1932 to March 1933

- Padi threshed by Hand.
- - - Padi threshed by Small Machine.
- Padi threshed by Large Machine.

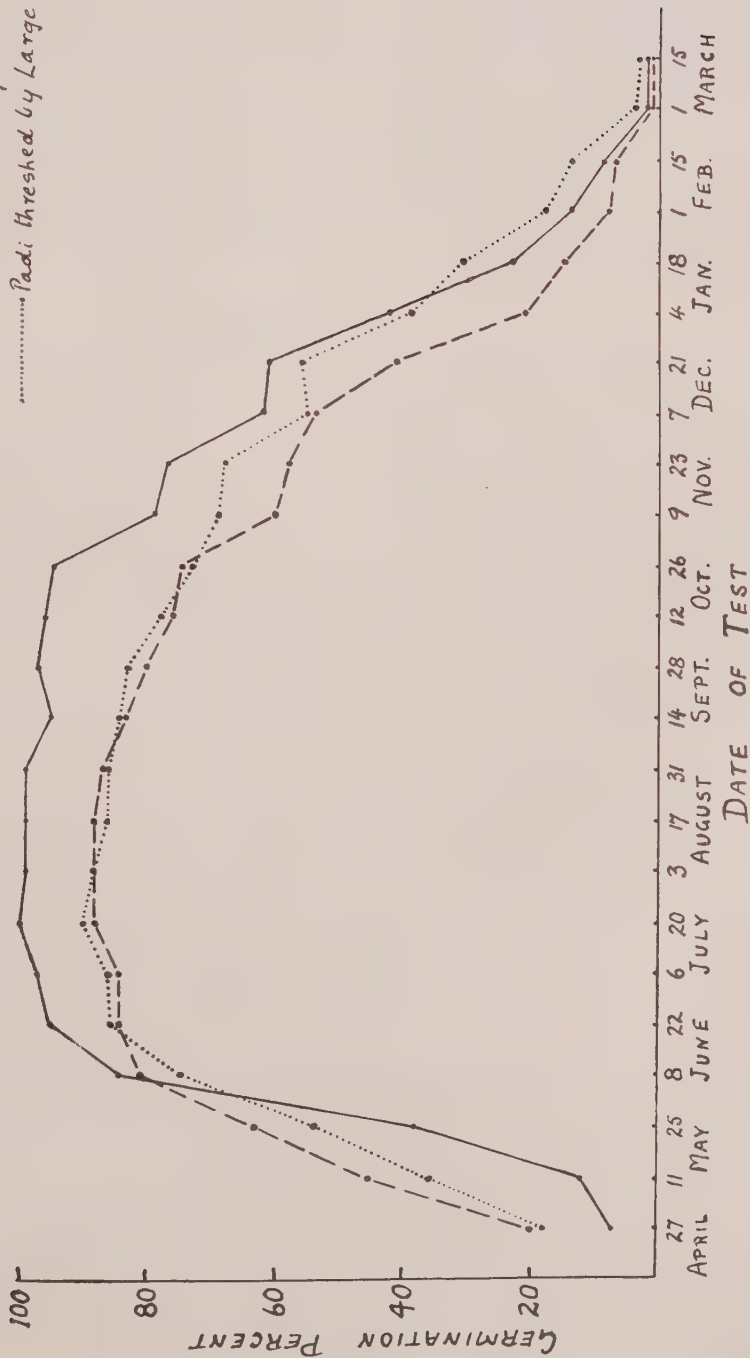


Fig. IX.

22. It will be seen that, for at least a month after harvesting, the germination was very poor. Germination began to increase rapidly after the fifth week and approached the maximum about two months from harvesting. This high figure was maintained for about 5 months, after which the viability began to fall off gradually up to a period of 11 months after harvesting, when germination practically ceased. Throughout the maximum period, the hand-threshed padi gave at least 10% higher germination than either of the machine-threshed classes.

23. Although it was not possible to include other varieties in this extended trial owing to lack of sufficient facilities, experience has indicated that similar results are obtained with *Demerara Creole*. It is to be concluded, therefore, that seed of these varieties should not be sown sooner than six weeks after harvesting, nor should it be stored longer than eight months, otherwise severe loss in viability will result.

RICE BREEDING WORK.

24. The breeding of new types of rice by hybridisation was initiated towards the end of 1931. The technique adopted in cross-pollinating is described by various authors, namely, Chao ⁽¹⁾, Jones ⁽²⁾, and Sampietro ⁽³⁾. Briefly, the method is this: the flowers are emasculated by making a transverse incision across the lemma and palea and extracting the anthers with a pair of forceps before they are ripe. Fertilisation is carried out by dusting the stigmas, when receptive, with pollen from the selected male parent. The process is extremely simple and it is possible to get good results by emasculating on the afternoon before flowering and pollinating between 9 and 10 a.m. the following morning. The emasculated panicle must be covered with a small paper bag to keep out wind-blown pollen and it is advisable to keep the panicle covered after pollination has been carried out, because the young developing grain, which is no longer protected by the inner glumes, is very liable to be destroyed by insects.

25. The chief aim of this line of research is to produce a variety which will possess strong straw, will mature in 4 to 4½ months and will give a high yield of grain of the Carolina type. With this end in view, the local variety, *Demerara Creole*, was crossed with several early maturing, stiff-strawed American varieties, namely, *Americano 1600*, *Mexican Edith*, *Lady Wright*, *Viola* and *Blue Rose*. In all these crosses, the F₁ plants were semi-sterile and the F₂ generations segregated into plants varying from completely fertile to completely sterile plants. By careful selection, however, this sterility character was practically eliminated by the F₄ generation.

26. Many of the crosses were discarded after the F₂ as being of no economic value; furthermore, owing to the necessity for economy of time and space, attention has been concentrated on the following three crosses:—

Americano 1600 x Demerara Creole.
Mexican Edith x Demerara Creole.
A 16.34 x H 7.

The third generations of these hybrids were planted out in November.

Other crosses which show promise, but which are only at the F₂ stage at present are:—

Garika Suama Vari x No. 79.
Kristna Kata Kulu x Carolina Edith.
Kristna Kata Kulu x No. 79.

⁽¹⁾ Chao, L.F. : *Genetics*. 1928: 3: 191—225.

⁽²⁾ Jones, J.W. : *J. Amer. Soc. Agron.* 1929: 21: 35-40.

⁽³⁾ Sampietro, G. : *Giorn. Riscolt.* 1929: 19: 81-90.

27. The first of these crosses should produce good results because the parents differ only in a few points. In pigmentation they are identical, the differences being that *Garika Suama Vari* possesses a shorter growth period and smaller grain than *No. 79*.

28. In the last two crosses the variety *Kristna Kata Kulu* has been included because it possesses a high yield which is due mainly to the large number of grains per panicle. Unfortunately, the grain is too small to be of commercial value, so an attempt is being made to evolve a large panicked variety with grain of the Carolina or of the *No. 79* type.

INHERITANCE STUDIES.

Sterility in rice hybrids.

29. During the course of the rice breeding work it has been possible to investigate the mode of inheritance of a large number of characters. The numerous varieties of rice, differing as they do in so many characters, make ideal subject matter for this type of research. Although all cultivated varieties so far investigated possess 12 haploid chromosomes, it has been found that there are certain races which, though perfectly fertile within themselves, when crossed with other races may show a high degree of sterility. According to Jones⁽¹⁾, this may be due to incompatibility of the chromosome mechanism.

30. As has already been mentioned, this type of irregularity was encountered in the crosses between American varieties and the local variety *Demerara Creole*. The number of sterile spikelets per panicle appeared to be fairly uniform throughout the F_1 plants, while in the F_2 , segregation took place into plants varying in degree of sterility from completely fertile to completely sterile plants.

31. Table VII gives some indication of the degree of sterility observed in three of the crosses. The figures were obtained by selecting three panicles from each F_1 plant and counting the fertile and sterile spikelets.

TABLE VII.

SHOWING THE PROPORTION OF FERTILE AND STERILE SPIKELETS IN THE F_1 PLANTS OF 3 CROSSES.

Nature of Cross.	No. of F_1 Plants.	Mean No. of Spikelets per panicle.			Ratio of Fertile to Sterile.
		Fertile.	Sterile.	Total.	
Mexican Edith x D.C.	8	55.5	99.4	154.9	1 : 1.8
Viola x D.C.	5	33.2	87.0	120.2	1 : 2.6
Americano 1600 x D.C.	6	35.0	70.3	105.3	1 : 2.0

These ratios are difficult to account for on Mendelian lines, but it is significant that each F_1 plant deviates very slightly from the mean ratio for each particular cross.

Chlorophyll Deficiency.

32. Another abnormal feature of these crosses between local and American varieties was the appearance of white and striped seedlings in the F_2 generations. Counts were made and the results are shown in Table VIII.

TABLE VIII.

SHOWING SEGREGATION INTO GREEN, WHITE AND STRIPED SEEDLINGS IN THE F_2 GENERATIONS OF VARIOUS CROSSES.

Nature of Cross.	No. Green Plants.	No. Striped Plants.	No. White Plants.	Ratio of Green and Striped to White.
Mexican Edith x D. C.	2,324	18	43	54 : 1
Viola x D. C.	278	—	6	46 : 1
Americano 1,600 x D. C.	1,009	5	17	60 : 1
Lady Wright x D. C.	173	3	5	35 : 1
D. C. x Blue Rose	344	—	8	43 : 1
Blue Rose x D. C.	2,534	8	47	54 : 1

(1) Jones, J. W. : J. Amer. Soc. Agron. 1930 : 22 : 861-867.

This type of segregation in the F_2 might be due to the recombination of three recessive genes, but is more probably a further indication of parental incompatibility. The data collected so far, however, are not sufficient to elucidate this interesting point.

Inheritance of Anthocyanic Pigment.

33. Observations in this connection will be briefly summarised here. Interest chiefly centres round the inheritance of pigment in colour patterns. In some crosses a simple pattern occurred which was inherited as a single unit, in others, several patterns were observed. In one case the colour was modified by a factor which changed the normal purple pigment to reddish purple. Anomalies were encountered in the crosses between *Demerara Creole* and the American varieties already referred to, and these can only be ascribed to abnormal enzymatic activity giving further indications of the incompatibility which exists between these varieties.

34. Pigmentation was dominant in every case, though in the last mentioned crosses, the colour appeared to be diluted in the F_1 , and, in the F_2 generations, a colour gradation from deep to very pale purple was observed. In all other crosses, the pigmented hybrids were just as deeply coloured as the pigmented parent.

35. *Simple inheritance of pigment in a single colour pattern.*—Colour in the apiculus, axil and stigma segregated as a single unit in two crosses, as is shown below in Table IX :—

TABLE IX.
INHERITANCE OF PIGMENT IN A SINGLE PATTERN.

Nature of Cross.	Colour of Pattern.	F_2 Segregation.
Blue Stick x No. 79	... Apiculus, axil, stigma	3 : 1
A 16.34 x H 7	... Apiculus, axil, stigma	3 : 1

No deviations from the pattern were observed out of 595 F_2 plants.

36. *More complicated cases of colour inheritance.*—This section deals with two crosses, *Ramcajara* x *Blue Stick* and *Rupununi* x *Kristna Kata Kulu*. The distribution of pigment in the parents and in the F_1 plants is shown below.

Colour Character.	Ramcajara.	Blue Stick.	F_1	Rupununi.	Kristna Kata Kulu.	F_1
Apiculus	...	purple	green	purple	green	purple
Axil	...	purple	green	purple	green	purple
Glume	...	purple	green	purple	green	purple
Husk	...	purple	green	purple	green	purple
Internode	...	purple	green	purple	green	green
Stigma	...	white	white	black	white	black

37. Segregation in the F_2 generations of these two crosses is summarised below in Table X :—

TABLE X.
MORE COMPLICATED SEGREGATION OF COLOUR PATTERNS.

Nature of Cross.	Colour Pattern.	F_2 Segregation.
<i>Ramcajara</i> x <i>Blue Stick</i> ...	Apiculus and axil ...	3 : 1
	Glume, husk and internode ...	9 : 7
	Stigma ...	9 : 7
<i>Rupununi</i> x <i>Kristna Kata Kulu</i> ...	Apiculus ...	3 : 1
	Stigma and axil ...	9 : 7
	Glume ...	9 : 7

38. A very close association was found between stigma and axil on one hand, and glume, husk and internode on the other. No case of crossing over was observed in 2,325 F_2 plants.

Husk Colour.

39. *Ripening Gold*—The variety *Rupununi* possesses husk and straw which ripen to a golden colour. This pigment is not of anthocyanic origin, and is recessive to the normal straw colour giving a 1 : 3 ratio in the F_2 . That it is independent of the group of factors for anthocyanic pigments is shown in Table XI. below :—

TABLE XI.
SHEWING SEGREGATION OF HUSK, INTERNODE AND GLUME COLOUR IN THE CROSS
RUPUNUNI X *KRISTNA KATA KULU*.

	Pigmented glume.	Non-pigmented glume.	Segregation of husk and internode colour.
Straw husk and internode ...	739 (772.9)	651 (601.1)	1,390 (1,374)
Golden husk and internode...	235 (257.6)	207 (200.4)	442 (458)

40. It will be remembered that glume colour segregated in a 9 : 7 ratio. The figures in brackets have been calculated on the basis of a 27 : 9 : 21 : 7 ratio. Golden colour in the husk and internode segregated as a single unit ; no case of crossing over was observed in 1,832 plants.

41. *Dark Furrows*.—The variety *A 16.34* exhibits no anthocyanic pigmentation, but the husk, when mature, is yellow brown in colour with dark brown furrows. This character also behaved as a recessive to the normal straw colour in the cross between *A 16.34* and *H 7*. No association was observed between this factor and the factors producing anthocyanic pigments, as will be seen from Table XII. below :—

TABLE XII.
SHOWING SEGREGATION FOR HUSK COLOUR AND ANTHOCYANIC PIGMENTS IN THE CROSS
A 16.34 & *H 7*.

	Pigmented apiculus axil and stigma.	Non-pigmented apiculus, axil and stigma.	Segregation of husk colour.
Straw coloured husk ...	183 (190)	67 (62)	250 (252)
Husk with brown furrows ...	51 (62)	24 (21)	85 (83)

42. The figures in brackets have been calculated on the assumption that the two characters are quite independent, giving a 9 : 3 : 3 : 1 ratio.

43. The foregoing is a brief summary of the more salient features of the inheritance studies carried out, a more detailed account of which will be published in due course.

L. E. CODD,
Plant Breeder.

April 21, 1933.

DEPARTMENT OF AGRICULTURE.

REPORT ON THE SUGAR EXPERIMENT STATIONS FOR THE
YEAR 1932.

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REPORT ON THE SUGAR EXPERIMENT STATIONS FOR THE YEAR 1932.

STAFF.

C. H. B. Williams, Dip. Agr. (A.I.C.T.A.)	—Cane Agronomist.
C. Cameron	—Field Manager.
J. Singh, Dip. Agr. (I.C.T.A.)	—Field Assistant.
L. A. Forte	—Field Assistant.
B. A. MacArthur	—Field Assistant.
L. A. Robinson	—Laboratory Assistant.
H. B. Singh	—Laboratory Assistant.
J. B. Bourne	—Clerical Assistant.

Mr. Cameron proceeded on six months' vacation leave on October 10. He is spending the entire period at the Imperial College of Tropical Agriculture, Trinidad, where he is studying cane breeding problems under Professor Cheesman.

2. Mr. Forte, who had been seconded for carrying out the field sampling in connection with the soil survey of the sugar estates owned or controlled by Messrs. Booker Bros., McConnell & Co., Ltd., returned to his normal duties on July 1.

3. Mr. Mac Arthur who had been acting for Mr. Forte, was appointed as an additional Field Assistant as from July 1.

4. Messrs. J. and B. Singh were appointed Field and Laboratory Assistants, respectively, from October 1, their emoluments being met from a special grant made by the Empire Marketing Board.

GENERAL.

5. *Committee.*—The Sugar Experiment Stations' Committee comprised, in January, 1932 :—

The Director of Agriculture, Chairman.
Hon. G. E. Anderson, Pln. Diamond.
Mr. J. C. Gibson, Pln. Port Mourant.
Mr. C. Farrar, New Amsterdam.
Hon. R. E. Brassington, Georgetown.
Mr. A. Murison, Pln. Uitvlugt.
Mr. J. Bee, Pln. Albion.

Mr. C. L. C. Bourne, Secretary to the Committee.

Its constitution was the same at the end of the year, the Hon. M. B. G. Austin having acted for Mr. Bee during the latter's absence from the Colony.

6. *Finance.*—The amount voted on the estimates for 1932 was \$16,820, the amount actually spent was \$17,136.17. The revenue from sale of canes exceeded the estimate by \$1,474.55. A grant of £900 was made to the Station by the Empire Marketing Board for the year July, 1932 to June, 1933. Up to the end of 1932, \$2,107.94 of this had been expended.

7. *Equipment.*—A motor truck has been purchased from the funds granted by the Empire Marketing Board. It will be of great service in bringing in samples of cane from the Sub-stations for analysis, transporting manures, etc.

8. The garage has been remodelled to afford shelter for the motor truck and three automobiles.

9. A rest room has been constructed over the store for the use of officers when they have to be at Sophia during the night.

10. A bridge has been erected over the east navigation trench.

CANE-BREEDING AND INTRODUCTION.

11. Further elimination has been made among the Demerara canes on the Station. These seedlings are being multiplied and tested in field trials as rapidly as possible. Those which show undesirable traits during the process of multiplication are discarded before reaching the experimental stage.

12. The following 96 Demerara seedlings are in replicated field tests :—

76/02	814/12	663/13	31/17	403/18	52/20	6/21
118/02		689/13	73/17	611/18	71/20	25/21
		695/13	84/17	666/18	73/20	92/21
		747/13	92/17	789/18	75/20	163/21
			195/17	794/18	203/20	173/21
			238/17	835/18	204/20	241/21
			376/17		207/20	364/21
			404/17		213/20	424/21
			447/17		246/20	438/21
			576/17		349/20	548/21
					351/20	613/21
					516/20	620/21
					577/20	628/21
					571/20	661/21
					604/20	684/21
					628/20	744/21
					679/20	857/21
					682/20	880/21
					699/20	893/21
						1034/21
						1867/21
	309/22	11/24	8/27	1/28		
	383/22		53/27	3/28		
	573/22			4/28		
	593/22			6/28		
	602/22			8/28		
	648/22			9/28		
	895/22			10/28		
	918/22			11/28		
	927/22			13/28		
	1034/22			15/28		
	1159/22			20/28		
	1175/22			23/28		
	1221/22			24/28		
	1431/22			50/28		
	1865/22			154/28		

It will be noticed that the total number is considerably greater than last year and that the 1928 seedlings, a promising-looking group, have now reached the experimental stage.

13. The standard cane of the Colony, D. 625. is used in all the tests, except at Pln. Diamond, where Diamond 10 is the accepted standard, and, in addition, the following introduced canes and Diamond seedlings are also being experimented with :

P.O.J.	213	Co.	210	B.	74
"	253	"	213	B.H.	10 (12)
"	1499	"	281	S.C.	12 (4)
"	2714	S.W.	3	Berbice	
"	2725	G.	119	Diamond	5
"	2727	L.C.T.A.	36	"	10
"	2753			"	17
"	2878				

A number of other introduced canes are being multiplied under observation and some will soon be put into replicated field trials. Included in this group are a number of Java-West Indian hybrids from Puerto Rico, and some of the newer Barbados and Trinidad seedlings.

14. The 1929 seedlings have been submitted to their second selection and 21 extended. The extension consists mainly of crosses between S.C.12 (4) and D. 625, together with a few D. 625 x B.H. 10 (12) crosses.

15. Of the 141 1930-seedlings mentioned in the last report as having been selected, 120 were chosen for further experimentation and again extended during 1932.

16. The 1931 seedlings have not yet been subjected to their first selection.

17. During the 1932 breeding season, the following 167 boxes of fluff were sown :—

	Boxes.		Boxes.
P.O.J. 2364 x Diamond 10	... 7	D.602/22 x Diamond 10	... 5
P.O.J. 2727 x Diamond 10	... 6	S.C.12 (4) x Diamond 10	... 5
P.O.J. 213 x D. 625	... 2	P.O.J. 2878 x Diamond 10	... 3
P.O.J. 2753 x Diamond 10	... 3	I.C.T.A. 36 x Diamond 10	... 5
Diamond 10 x S.C.12 (4)	... 2	S.W. 3 x Diamond 10	... 3
I.C.T.A. 36 x S.W. 3	... 3	D. 625 x S.C.12 (4)	... 12
D. 625 x Diamond 10	... 8	Diamond 10 x D. 625	... 4
S.C. 12 (4) x D. 625	... 3	P.O.J. 2364	... 6
G. 312	... 6	I.C.T.A. 36	... 9
Ba. 11569	... 2	E. K. 28	... 3
S. C. 12 (4)	... 9	D. 602/22	... 4
Co. 281	... 2	D. 1441	... 6
P.O.J. 139	... 1	Diamond 10	... 2
P.O.J. 1499	... 2	Ba. 6835	... 3
Green Transparent	... 9	B.H. 10 (12)	... 3
Leonardina	... 3	Co. 213	... 3
S. W. 3	... 2	Berbice	... 4
D. 145	... 6	B. 1529	... 6
Melligeli	... 1	G. 153	... 2
Manie	... 1	T. J. E. P. 24	... 1

18. No new introductions of cane were made during the year. Some of the earlier introductions have been removed from quarantine and are now growing at Sophia. The Puerto Rican and Trinidad varieties introduced in 1931 are still in quarantine.

EXPERIMENTATION.

Experiments Reaped.

19. Twenty-one variety trials have been reaped. The results which are appearing in *Sugar Bulletin* No. 1, have enabled a great deal of elimination to be done among the older varieties and point to Diamond 10 and P.O.J. 2878 as being *likely* to outyield D. 625, which, however, still gives satisfactory yields. D. 666 18 appears, from the trials to be about equal to D. 625. The following canes have shown up well ahead of D. 625 :

D. 92/17, 52/20, 204/20, 927/22, 207/20, 895/22, 573/22, S.W. 3.

As, for the most part, they have only been reaped as plant canes, and in a single trial in each instance, further experimental work must be done with them before any conclusions can be drawn. In the case of Diamond 10 and P.O.J. 2878, it is felt that two seasons' work is meagre evidence on which to base recommendations for a change of variety, especially when the standard cane is maintaining and

increasing its output per acre, but the results obtained are so encouraging that planters have been advised to make small commercial plantings which can be rapidly extended if further results confirm those as yet obtained. The trials so far reaped point to certain cases being well adapted to certain areas and less suited to others.

20. Eight manurial trials have been reaped. Their results too are appearing in *Sugar Bulletin* No. 1. Very briefly, there are four main types of land, planted, viz. :—

- Unflooded frontland (reducing in area),
- Flooded frontland (the major portion of the area planted),
- Unflooded pegasse,
- Flooded pegasse,

and it is clear that the manurial requirements of each of these need careful investigation. The results obtained to date indicate that:

- (1) On unflooded frontland soils and on ratoons on flooded land, doses of sulphate of ammonia, as high as 4 cwt. per acre may prove economically sound;
- (2) On flooded frontland soil, doses of more than 2 cwt. sulphate of ammonia per acre are not likely to prove economical on plant canes;
- (3) On unflooded pegasse it might be advantageous to apply as much as 6 cwt. sulphate of ammonia per acre to plant canes;
- (4) Dressings of ground limestone may be expected to increase the yield of both plants and first ratoons on unflooded clay or pegasse, and that there is no difference between the effects of this and slaked lime, though the former is cheaper to buy, store and apply;
- (5) On unflooded clay at Sophia, neither phosphate nor potash had any effect on yields of cane or sucrose;
- (6) On unflooded pegasse at Diamond, 2 cwt. sulphate of potash produced a statistically significant increase in the yield of plant canes;
- (7) Heavy doses of limestone may reduce purity, while heavy doses of nitrogen as sulphate of ammonia sometimes reduce purity and sucrose content and cause a rise in glucose ratio;
- (8) No definite response has been obtained from the application of lime-bearing materials to flooded clay.

21. Three trials with covered bamboo drains have been reaped, one on second ratoons in Field 4 West, Sophia, and two on first ratoons in Field 9 West, Sophia. The results are compared in detail in *Sugar Bulletin* No. 1. So far as Field 4 West is concerned, plant cane, first ratoon and second ratoon results all indicated marked increases in yield due to bamboo drainage. In Field 9 West, definite and statistically significant increases from the plant canes and suggestive, though not significant, increases from the first ratoons have been demonstrated. Open bed drills also gave increased yields, but the increments were not as marked as those obtained from bamboo drains. No correlation was found between the yield of the individual plots, and the salt content or reaction of the soil just after harvest.

22. Two spacing experiments were reaped, one with S.C.12 (4) and with D.602/22 and D. 625. In neither case did the variation in the spacing of rows have any very marked effect on the yields.

23. The reaping of the various experiments has involved weighing with portable balances in the field, close on 3,000 tons of cane from 1,307 separate plots, the transport of 34 tons of sample cane to be crushed in the experimental mills, and the making of 960 separate analyses. In addition, 174 samples were crushed and analysed for the Entomologist investigating the moth-borer of sugar cane.

Experiments Started.

24. The following is a list of the field experiments in progress on December 31, 1932.

Estate.	Field.	Age of Cycle.	Kind of Experiment.	Number of		Layout.
				Treatments.	Replicates.	
Sophia	*	1 E.	Plants	Variety	8	Latin Sq.
"	"	2 E.	Plants	Manurial	8	Randomised Blocks.
"	"	2 E.	Plants	"	5	"
"	"	3 E.	Plants	Variety	6	Latin Sq.
"	"	4 E.	1st Ratoons	"	10	Randomised Blocks.
"	"	5 E.	1st Ratoons	"	10	"
"	"	6 E.	1st Ratoons	"	5	"
"	"	8 E.	1st Ratoons	"	10	"
"	"	9 E.	1st Ratoons	"	10	"
"	"	10 E.	1st Ratoons	"	10	"
"	"	14 E.	1st Ratoons	"	6	Latin Sq.
"	"	17 E.	2nd Ratoons	Manurial	5	"
"	*	1 W.	Plants	Variety	4	"
"	*	2 W.	Plants	"	7	Randomised Blocks.
"	"	3 W.	Plants	"	7	"
"	"	5, 7, 8 W.	2nd Ratoons	Manurial	32	"
"	"	9 W.	2nd Ratoons	Drainage	4	Latin Sq.
"	"	9 W.	2nd Ratoons	Drainage	4	"
"	*	10 W.	Plants	Variety	7	Randomised Blocks.
"	*	11 W.	Plants	"	7	"
"	*	12 W.	Plants	Manurial	6	Latin Sq.
"	*	14 W.	Plants	Variety	6	"
"	*	15 W.	Plants	"	7	"
Port Mourant	"	6 R.	2nd Ratoons	"	6	Randomised Blocks.
"	"	8 A.	1st Ratoons	"	12	"
"	"	14 A.	Plants	"	10	"
"	"	6 A.	1st Ratoons	Manurial	16	"
"	"	T. W.	Plants	Flood-fallow	4	Latin Sq.
"	"	T. L.	Plants	Flood-fallow	4	"
"	**	4 E. M. H.	Plants	Manurial	4	"
Blairmont	"	11 R.	2nd Ratoons	Variety	10	Randomised Blocks.
"	"	18 R.	1st Ratoons	"	12	"
"	"	4 H.	Plants	"	9	"
"	"	47 B. L.	2nd Ratoons	Manurial	7	Latin Sq.
Cane Grove	**	22 P.	Plants	"	5	"
Enmore	**	8 B. A.	Plants	"	4	"
Lusignan	"	19 E.	2nd Ratoons	Variety	7	Randomised Blocks.
"	"	22 B. M. R.	1st Ratoons	"	12	"
"	"	38 A.	Plants	"	10	"
"	**	4 E. M. E.	Plants	Manurial	5	Latin Sq.
"	**	28 E. G. H.	Plants	"	4	"
"	"	F.	Plants	Flood-fallow	4	"
"	"	H.	Plants	Flood-fallow	4	"
"	"	61 E.	Plants	Variety	8	"
Ogle Farm	"	86 G. D.	1st Ratoons	Manurial	20	Randomised Blocks.
Diamond	"	53 G. D.	2nd Ratoons	Variety	10	"
"	"	89 G. D.	1st Ratoons	"	12	"
"	"	90 G. D.	Plants	"	11	"
Leonora	"	21 G. V.	1st Ratoons	Manurial	7	"
Uitvlugt	"	10 Z.	1st Ratoons	Variety	10	"
"	**	13 E.	Plants	"	11	"
"	**	94 M. Z.	Plants	Manurial	5	Latin Sq.
"	"	75 Z.	1st Ratoons	"	7	Randomised Blocks.
"	"	37 E.	Plants	"	5	Latin Sq.
Non Pareil	"	14 Ent.	1st Ratoons	Variety	11	Randomised Blocks.
"	"	59 E.	Plants	"	11	"

25. Of the 56 trials listed above, 27 (marked with one or two asterisks) were started during 1932. Several of the new variety trials contain 1928 seedlings which are now being tested for the first time.

26. The flooding trials at Port Mourant and Lusignan have been designed :

1. To measure the effect of flood-fallowing for 4, 6 and 12 months, respectively, with an application of one ton of limestone (a) before flooding and (b) after flooding; and
2. To determine what will be the effect on the yield of cane, after six-months' fallow, of
 - (a) Keeping the water 6-12 inches deep so that the fallow is "clean,"
 - (b) Lowering the water level to encourage the growth of semi-aquatic weeds and herbs,
 - (c) Sowing aquatic plants in the flood water,
 - (d) Adding 5 tons of molasses per acre to the flood water.

The execution of field tests with flood-fallowing is both difficult and costly and great credit is due to the Estates concerned for undertaking the trials. A portion of the expense involved will be borne from the Empire Marketing Board Grant.

27. Flood-fallowing is now an established practice on the clay lands of the Colony and its use appears to be spreading to the pegasse lands. There can be no doubt but that the yield of cane is markedly increased if the frontland soils are left under water for periods of 4 to 12 months, and this practice, more perhaps than any other single factor, has contributed to the increased output of sugar per acre in recent years. The reasons for the improvement are obscure. The Chemist-Ecologist's laboratory investigations have thrown some valuable light on the subject, and it is felt that these field trials may help to lead to a better understanding of the phenomenon and, consequently, to a more advantageous use of the procedure.

28. The trials marked with two asterisks have been started with the aid of a special joint contribution from Messrs. Booker Bros., McConnell & Co., Ltd., and Messrs. The Imperial Chemical Industries, Ltd. They form part of a series to be laid down throughout the sugar belt on

- (a) Flooded clay,
- (b) „ pegasse,
- (c) Unflooded pegasse,

to determine the requirements of these soil types for nitrogen in the form of sulphate of ammonia. These are being laid down in collaboration with the Chemist-Ecologist.

MISCELLANEOUS.

29. *Soil Samples*.—112 of these have been taken and submitted to the Chemist-Ecologist. They represent composite top and subsoil samples from all sites on which experiments have been started and a certain number of special samples.

30. *Plant Distribution*.—3,044 bags of cuttings have been distributed locally. These were estimated to contain well over 400,000 cuttings. The varieties distributed consisted mainly of Diamond 10, P.O.J. 2870, D. 602/22 and a number of 1928 seedlings.

31. *Sale of Canes*.—542 puntloads of cane were sold to Plantation Ogle for \$2,974.55. The revenue from this source was, thus, more than double that of last year.

32. *Visits*.—127 visits were made to estates by various members of the Station's staff. Many of these visits in connection with experimental work extended over several days.

33. *Office*.—The usual correspondence has been dealt with, and the keeping of records and indices maintained. With the increase in the number of trials reaped, the computation and statistical examination of the results obtained involves a great deal of time.

34. No publications have been issued during the year owing to the temporary cessation of publication of *The Agricultural Journal of British Guiana*.

35. Monthly reports on the Station have been regularly submitted to the Director of Agriculture and a half-yearly report to the Committee.

C. HOLMAN B. WILLIAMS,
Sugar Cane Agronomist.

January 2, 1933.

DEPARTMENT OF AGRICULTURE.

REPORT OF THE CHEMICAL DIVISION FOR THE YEAR 1932.

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REPORT OF THE CHEMICAL DIVISION FOR THE YEAR 1932.

STAFF.

R. R. Follett-Smith	—Chemist Ecologist.
C. L. C. Bourne	—Assistant Chemist.

GENERAL.

2. The Assistant Chemist was granted casual leave from January 12 to February 8. The Chemist Ecologist was absent on vacation leave from April 15 to September 27.

3. The number of samples of cane analysed, in connection with the variety and manurial trials laid down by the Agronomist, has increased. In addition, 173 samples of cane submitted by the Entomologist in charge of the moth-borer investigation were tested. Lack of staff prevented the examination of parcels of cane from individual plots of each experiment. In some of the manurial trials, where little variation in the sucrose quality of the cane was anticipated, composite samples only were analysed. This increased activity in the sugar laboratory necessitated the withdrawal of the laboratory assistant (Mr. L. A. Robinson) from the general laboratory. In consequence for half the period under review only one officer has worked in the soil laboratory.

4. The division has been occupied with soil survey work on the coastlands. No surveys have been made in the interior but numerous samples, collected by Government officers, have been submitted to laboratory examination and have formed the subject of a number of reports. The division has given a considerable amount of time to the design and statistical reduction of manurial trials with cane and padi. As in the past, carefully collected soil samples from the various experimental sites have been analysed and the results continue to be of use in advisory work. A number of advisory visits have been paid to the plantations of the colony.

5. The detailed soil survey of the cane lands of Messrs. Booker Bros. estates was continued during the year. The collection and preliminary examination of 5,786 soil samples, spaced over 34,617 acres, were completed in June, 1932 (twelve months after the inception of the scheme). The detailed analysis of composite samples and the production of final reports are being continued. This work has attracted the notice of the Imperial Chemical Industries, Limited, who, jointly with Messrs. Booker Bros., McConnell & Co., have provided funds for the extension of field experiments with manures on the various soil types delineated.

Soil Surveys.

6. During the period under review no soil surveys were carried out in the interior of the colony. Several collections of soil samples were, however, submitted for examination. These included—

- (a) Forty soil samples, from the neighbourhood of the bridge at $71\frac{3}{4}$ miles on the Bartica-Potaro Road, forwarded by the Commissioner of Lands and Mines.
- (b) Ten soil samples from Pln. Lochaber, Berbice, submitted by the Manager.
- (c) Thirty-two samples from representative padi lands of Wakenaam Island and the Essequibo Coast, submitted by the Agricultural Superintendent, Essequibo.
- (d) Five samples from the Berbice savannahs, submitted in connection with a recent colonisation survey.
- (e) Numerous samples of soil from various plantations for advisory purposes.

Advisory Visits.

7. During the year nine advisory visits have been paid to the plantations of the colony.

Examination of Samples.

8. The division has collected and examined 362 samples of soil as compared with 436 samples during the previous year. During the period 1,134 samples of cane were analysed as compared with 793 for the previous period.

9. The following samples (excluding the 5,786 soil samples collected in connection with the Booker's survey) have been examined during the year:—

Soil samples	...	...	362
Cane samples	...	...	1,134
Clay fractions	...	...	10
Lime bearing materials	...	...	5
Molasses	...	...	2
Fertilisers	...	...	1
Plant material	...	...	1
Distillery lees	...	...	1

SUGAR CANE SOIL INVESTIGATIONS.

10. The two main soil types of the Colony's sugar estates, the front land soil and the pegasse, have already been described in some detail (Rept. Chem. Div. 1931 pp. 68-80). It has been possible to open, examine and sample profile pits in representative areas of the two soil types. The pits were examined and sampled by the Chemist Ecologist while the laboratory work was undertaken by the Assistant Chemist. Both pits were sampled in six-inch layers in order to trace, in detail, the variation in salinity, texture and reaction. The profile in addition were sampled a second time in horizons according to their appearance.

11. The results obtained by the examination of the individual six-inch layers of each profile appear in Table I.

TABLE I
FRONT LAND SOIL.

Sample No.	Lower depth.	pH Normal.	pH Exchange.	Index of Texture.	% Soluble Salts.
D 636	6"	5.09	3.88	49	0.037
D 637	12"	4.96	3.86	53	0.087
D 638	18"	4.98	3.96	52	0.193
D 639	24"	6.34	5.18	54	0.313
D 640	30"	6.89	5.89	56	0.382
D 641	36"	7.22	6.31	58	0.393
D 642	42"	7.37	6.44	56	0.471
D 643	48"	7.48	6.72	59	0.552
D 644	54"	7.77	7.05	60	0.611
D 645	60"	7.95	7.16	61	0.671
D 646	66"	8.22	7.65	20	0.452
D 647	72"	8.22	7.43	49	0.690
PEGASSE SOIL.					
D 685	6"	5.61	4.23	51	0.013
D 686	12"	5.02	3.93	57	0.007
D 687	18"	5.20	3.75	51	0.006
D 688	24"	4.93	3.65	54	0.008
D 689	30"	4.54	3.58	55	0.021
D 690	36"	4.85	3.62	53	0.010
D 691	42"	4.93	3.58	54	0.019
D 692	48"	4.95	3.62	51	0.007
D 693	54"	5.02	3.62	53	0.009
D 694	60"	4.62	3.27	56	0.011
D 695	66"	4.60	3.30	55	0.011
D 696	72"	4.21	3.36	55	0.046

These figures demonstrate some of the marked differences between these examples of the two soil types.

12. The *front land* profile is highly acidic to a depth of eighteen inches; below this point there is a definite change in soil reaction which becomes more alkaline with increasing depth. The top layer of the *pegasse* profile is slightly less acidic, due to recent dressings of ground limestone, below this point there is a gradual but conspicuous tendency towards increased acidity with increasing depth.

13. The salinity of the top layer of the *front land* profile is low. From this point to a depth of sixty-six inches there is a notable and regular increase in salinity. The salt content drops somewhat in the penultimate layer but increases again in the lowest layer. The salinity of the *pegasse* soil profile is very low and shows no variation throughout the profile.

There is a gradual but regular increase in soil texture in the *front land* profile to a depth of sixty-six inches. In the two lowest layers a lighter soil is encountered. In the *pegasse* soil profile the soil texture does not vary markedly with depth.

14. The samples collected from the horizons of the profiles were examined in great detail. The description of the samples collected and the appearance of the *front land* profile is as follows :—

Sample No. D. 631 0-7 ins. Brown clay. No mottling. Friable. Many roots present.

Sample No. D. 632 7 ins.-13 ins. Light brown clay. A little orange red mottling. Not friable. Many roots present.

Sample No. D. 633 13 ins.-19½ ins. Grey clay with very considerable amount of orange-red mottling. Not friable.

Sample No. D. 634 19½ ins.-58½ ins. Light grey, heavy, soapy clay. A certain amount of red mottling. In the lower depths of the horizon soil channels, like pipe stems with a rusty interior, run vertically through the soil.

Sample No. D. 635 58½ ins.-76½ ins. Blue grey, heavy, moist clay, possessing a green (ferrous) bloom when freshly broken. Small-crystalline specks of quartz or mica. The soil does not appear to oxidise quickly.

The results of the detailed examination of these samples appear in Table II.

TABLE II.

Sample Number.	D 631.	D 632.	D 633.	D 634.	D 635.
Lower depth ...	7"	13"	19½"	58½"	76½"
Normal reaction pH ...	5.23	4.83	4.95	7.39	8.32
Exchange reaction pH ...	3.91	3.84	3.96	6.52	7.58
Index of texture ...	47	54	56	59	43
Per cent. Soluble Salts ...	0.024	0.083	0.173	0.412	0.575
Per cent. Carbon ...	0.936	0.744	0.361	0.220	0.439
Per cent. Nitrogen ...	0.145	0.120	0.083	0.073	0.069
Carbon : nitrogen ratio ...	7.28	7.19	4.72	3.70	6.36
Per cent. Clay ...	60.2	56.7	65.6	60.8	39.1
Lime requirement per cent. CaCO ₃ ...	0.525	0.544	0.370	0.023	nil
Clay Fraction—					
Per cent. Silica ...	48.32	48.46	47.72	48.84	48.95
Per cent. Alumina ...	25.07	26.60	26.19	24.62	25.10
Per cent. Ferric oxide ...	8.81	8.10	8.95	10.12	9.56
Molecular ratio SiO ₂ ...	3.27	3.10	3.10	3.37	3.31
Al ₂ O ₃ ...					
Molecular ratio SiO ₂ ...	2.67	2.58	2.54	2.66	2.65
R ₂ O ₃ ...					
Exchangeable bases (mgm. eq. per cent.)					
Lime ...	4.56	3.46	2.73	3.98	10.85
Magnesia ...	9.52	8.98	10.10	14.55	19.36
Potash ...	0.32	0.23	0.04	0.50	1.17
Soda ...	0.70	0.88	2.01	2.63	0.77
Water soluble bases (mgn. eqs. per cent.)					
Lime ...	0.20	0.30	0.40	0.40	0.55
Magnesia ...	0.18	0.36	0.54	1.09	1.09
Potash ...	0.04	0.04	0.21	0.16	0.53
Soda ...	0.23	0.94	2.22	5.98	10.09
Water soluble acid radicles (mgm. eq. per cent.)					
Chloride ...	0.50	0.90	1.00	5.60	7.00
Sulphate ...	0.08	0.26	0.51	0.68	0.80
Carbonate ...	nil	nil	nil	0.40	2.20

15. The description of the samples collected and the appearance of the *pegasse* profile is as follows :—

Sample No. D. 697 0-7½ ins. Friable clay soil, black when moist and dark grey when dry.

Sample No. D. 698 $7\frac{1}{2}$ ins.- $13\frac{1}{2}$ ins. A moist black friable clay.
 Sample No. D. 699 $13\frac{1}{2}$ ins.-20 ins. A pale buff clay with a whitish tinge.
 No mottling.
 Sample No. D. 700 20 ins.-51 ins. A pale buff clay speckled with orange
 mottling.
 Sample No. D. 701 51 ins.-75 ins. Soil similar in appearance to that of
 previous sample.

The result of the detailed examination of these samples appear in Table III.

TABLE III.

Sample Number.	D 697	D 698	D 699	D 700	D 701
Lower depth	7 $\frac{1}{2}$ "	13 $\frac{1}{2}$ "	20"	51"	75"
Normal reaction pH	4.85	4.85	4.60	4.80	4.62
Exchange reaction pH	3.49	3.79	3.54	3.49	3.42
Index of texture	54	56	51	51	52
Per cent. Soluble Salts	0.020	0.007	0.007	0.010	0.016
Per cent. Carbon	2.928	3.313	0.681	0.341	0.715
Per cent. Nitrogen	0.252	0.218	0.099	0.069	0.082
Carbon: nitrogen ratio	11.6	15.2	6.88	4.95	8.71
Per cent. Clay	34.5	34.8	47.8	50.7	56.8
Lime requirement per cent CaCO ₃	0.684	1.013	0.766	0.733	0.718
Clay fraction					
Per cent. Silica	46.46	46.79	46.82	46.22	43.68
Per cent. Alumina	29.64	29.23	30.61	28.08	29.18
Per cent. Ferric Oxide	5.24	5.70	7.14	11.27	8.78
SiO ₂					
Molecular ratio	2.65	2.71	2.59	2.79	2.83
Al ₂ O ₃					
SiO ₂					
Molecular ratio	2.38	2.41	2.26	2.22	2.37
R ₂ O ₃					
Exchangeable bases (mgm. eqs. per cent.)					
Lime	8.52	1.12	1.20	1.16	0.96
Magnesia	1.60	trace	0.28	1.88	6.04
Potash	0.30	0.10	0.10	0.26	0.33
Soda	0.28	0.19	0.05	0.17	0.58

The area in which this profile pit was excavated received, two years previously, a dressing of ground limestone at the rate of two ton per acre.

In the *front land* profile the carbon content decreases and the carbon : nitrogen ratio narrows with increasing depth. In the lowest horizons the carbon content increases and the carbon : nitrogen ratio widens. This general trend is also noted in the *pegasse* soil profile. The third horizon contains rather more clay and suggests that some of the finer portions of the soil have been washed out of the top foot of soil. The lowest horizon contains markedly less clay.

16. It is of interest to examine the various proportions of exchangeable bases in the different horizons of the two profiles. For this purpose it is assumed that the lime requirement method of Hardy and Lewis furnishes an estimate of the exchangeable hydrogen in the soil. The varying percentages of the different bases in the horizons of the two profiles appear in Table IV.

TABLE IV.
PERCENTAGE VALUES OF EXCHANGEABLE BASES.

		Lime.	Magnesia.	Potash.	Soda.	Hydrogen.	Exchange capacity mgm. eq., per 100 gms.
Front Land Soil	0-7"	17.8	37.2	1.2	2.7	41.0	25.60
	7"-13"	14.2	36.8	0.9	3.6	44.6	24.45
	13"-19 $\frac{1}{2}$ "	12.2	45.4	0.0	9.0	33.2	22.28
	19 $\frac{1}{2}$ "-58 $\frac{1}{2}$ "	18.0	65.8	2.3	11.9	2.3	22.12
	58 $\frac{1}{2}$ "-76 $\frac{1}{2}$ "	23.8	60.2	3.6	2.4	0.0	32.15
Pegasse Soil	0-7 $\frac{1}{2}$ "	35.0	6.6	1.2	1.1	56.1	24.40
	7 $\frac{1}{2}$ "-13 $\frac{1}{2}$ "	5.2	0.0	0.5	0.9	93.5	21.71
	13 $\frac{1}{2}$ "-20"	7.1	1.7	0.6	0.3	90.5	16.93
	20"-51"	6.4	10.3	1.4	0.9	80.9	18.17
	51"-75"	4.3	27.1	1.5	2.6	64.5	22.31

17. Considering first the *front land* profile, this soil was originally laid down in sea water and consequently was consolidated in the presence of more sodium salts than magnesium salts. It appears that soda, if it at first entered the absorbing complex did not persist to any great extent but that a considerable amount of magnesia assumed an exchangeable form. The effects of leaching and cultivation upon the profile are apparent. There is a slight accumulation of exchangeable lime in the first horizon due, probably, to past dressings of lime-bearing materials. The figures demonstrate the replacement of exchangeable magnesia and soda by hydrogen in the first three horizons of the profile. The state of unsaturation of the absorbing complex in these three horizons exposes it to the possibility of degradation and the analytical figures for the composition of the clay fractions of the horizons present some evidence of incipient change. Slight eluviation of ferric oxide and alumina has taken place and this is reflected in the values obtained for the molecular ratios of silica to alumina and to sesquioxides.

18. The *pegasse* profile has been subjected to a longer period of leaching. The high value for exchangeable lime in the first horizon is, of course, due to recent applications of ground limestone. It will be noted that the replacement of exchangeable lime, magnesia and soda by hydrogen has proceeded much further in this profile. The preponderating replaceable ion throughout the profile is hydrogen. The analytical figures for the composition of the clay fractions of this profile indicate that a certain amount of decomposition of the mineral absorbing complex has taken place. While no marked eluviation of alumina is to be noted yet a decided downward movement of iron is manifest.

19. Of the two soil types here described the *pegasse* soil has reached a more advanced stage of weathering. The *pegasse* soil was originally laid down by sea water and was, in the first place, a saline soil. At a later stage the soil was protected from further inundations with sea water by sand reefs thrown up by changing currents. The soil was then flooded with fresh water from the interior and accumulations of acid organic matter were formed. Under these conditions the originally saline soil became desalinised and eventually podzolised. This soil type does not form a good medium for the growth of cane and the obvious remedy is a heavy application of limestone. The economics of such a procedure are being investigated by field experiments.

20. The *front land* soil was laid down by sea water and was, in the first instance, a saline soil. Cultivation, irrigation and drainage are bringing about a gradual desalination. This soil type will never develop into a *pegasse* for cultivation methods do not permit of the accumulation of organic matter. On the other hand the soil is becoming progressively more acid and more unsaturated. It would appear to be necessary to arrest these changes by the periodic application of small dressings of limestone. This aspect is also receiving attention in the form of field trials.

21. Briefly the chief differences between the profiles of the two soil types are:—

- (a) A marked increase in salinity and alkalinity with depth in the *front land* clay. The *pegasse* soil is non-saline and highly acidic throughout the profile.
- (b) The marked accumulation of organic matter in the upper layers of the *pegasse* profile.
- (c) The narrow carbon: nitrogen ratio of the *front land* clay profile and the wider ratio of the *pegasse* profile.
- (d) The small amount of exchangeable bases present in the soil of the *pegasse* profile.
- (e) The narrower silica-sesquioxide ratio in the clay fraction of the *pegasse* profile.

22. In paragraph 31 of the report of the division for the year 1931 mention was made of a detailed soil survey of the estates of a large sugar combine of the colony. This survey was commenced on June 22, 1931 and should be completed in June, 1933. During the first year 5,786 samples of topsoil and subsoil were collected from 2,893 sites scattered over an area of 34,617 acres. The preliminary examination of these samples, which includes measurements of normal reaction, exchange reaction, texture and salinity, has been concluded and it is of interest to record the results obtained.

23. The estates surveyed were situated in three districts, namely the West Coast of Demerara, the East Coast of Demerara and the East Coast of Berbice. The frequency distributions of the individual samples collected from these three districts are shown in Tables V., VI., VII. and VIII.

TABLE V.
DISTRIBUTION OF SAMPLES ACCORDING TO NORMAL REACTION.
TOPSOILS.

Normal reaction.	Demerara, West Coast.	Demerara, East Coast.	Berbice, East Coast.	Total.
Below pH 4.00 —Very Highly Acid ...	7 (0.9%)	3 (0.3%)	...	10 (0.3%)
pH 4.00—pH 4.99—Highly Acid ...	581 (76.7%)	788 (68.5%)	118 (12.0%)	1,487 (51.4%)
pH 5.00—pH 5.99—Markedly Acid ...	170 (22.4%)	335 (29.1%)	755 (76.7%)	1,260 (43.6%)
pH 6.00—pH 6.99—Slightly Acid ...	...	17 (1.8%)	107 (10.9%)	124 (4.3%)
Above pH 7.00 —Alkaline ...	...	8 (0.7%)	4 (0.4%)	12 (0.4%)
Total ...	758	1,151	984	2,893

SUBSOILS.

Below pH 4.00 —Very Highly Acid ...	17 (2.2%)	12 (1.0%)	1 (0.1%)	30 (1.0%)
pH 4.00—pH 4.99—Highly Acid ...	556 (73.8%)	694 (60.2%)	138 (14.0%)	1,387 (48.0%)
pH 5.00—pH 5.99—Markedly Acid ...	181 (23.9%)	356 (30.9%)	323 (32.8%)	860 (29.8%)
pH 6.00—pH 6.99—Slightly Acid ...	4 (0.5%)	75 (6.5%)	462 (47.0%)	541 (18.7%)
Above pH 7.00 —Alkaline ...	1 (0.1%)	14 (1.2%)	60 (6.1%)	75 (2.6%)
Total ...	758	1,151	984	2,893

TABLE VI.
DISTRIBUTION OF SAMPLES ACCORDING TO EXCHANGE REACTION.
TOPSOILS.

Exchange reaction.	Demerara, West Coast.	Demerara, East Coast.	Berbice, East Coast.	Total.
Below pH 4.00 —Highly Acid ...	689 (90.9%)	913 (79.3%)	166 (16.9%)	1,768 (61.1%)
pH 4.00—pH 4.99—Markedly Acid ...	68 (9.0%)	212 (18.4%)	752 (76.4%)	1,032 (35.7%)
pH 5.00—pH 5.99—Slightly Acid ...	1 (0.1%)	17 (1.5%)	62 (6.3%)	80 (2.8%)
Above pH 6.00 —Alkaline ...	...	9 (0.8%)	4 (0.4%)	13 (0.4%)
Total ...	758	1,151	984	2,893

SUBSOILS.

Below pH 4.00 —Highly Acid ...	704 (92.9%)	702 (61.0%)	98 (10.0%)	1,504 (52.0%)
pH 4.00—pH 4.99—Markedly Acid ...	51 (6.7%)	328 (28.5%)	310 (31.5%)	689 (23.8%)
pH 5.00—pH 5.99—Slightly Acid ...	2 (0.3%)	103 (8.9%)	455 (46.2%)	560 (19.4%)
Above pH 6.00 —Alkaline ...	1 (0.1%)	18 (1.6%)	121 (12.3%)	140 (4.8%)
Total ..	758	1,151	984	2,893

TABLE VII.
DISTRIBUTION OF SAMPLES ACCORDING TO TEXTURE.

TOPSOILS.

Index of Texture.	Demerara, West Coast.	Demerara, East Coast.	Berbice, East Coast.	Total.
0-20-Sand and Light Loam ...	2 (0.3%)	8 (0.7%)	6 (0.6%)	16 (0.6%)
21-30-Heavy Loam ...	15 (2.0%)	12 (1.0%)	9 (0.9%)	36 (1.2%)
31-40-Fine Silt ...	54 (7.1%)	104 (9.0%)	47 (4.8%)	205 (7.1%)
41-45-Heavy Silt ...	60 (7.9%)	198 (17.2%)	283 (29.3%)	546 (18.9%)
46-55-Clay ...	255 (33.6%)	677 (58.8%)	622 (63.3%)	1,554 (53.7%)
56-65-Pegassy Clay ...	206 (27.1%)	139 (12.1%)	12 (1.2%)	357 (12.3%)
Above 65-Pegasse ...	166 (21.9%)	13 (1.1%)	...	179 (6.2%)
Total ...	758	1,151	984	2,893

SUBSOILS.

0-20-Sand and Light Loam ...	1 (0.1%)	8 (0.7%)	3 (0.3%)	12 (0.4%)
21-30-Heavy Loam ...	6 (0.8%)	12 (1.0%)	11 (1.1%)	29 (1.0%)
31-40-Fine Silt ...	33 (4.4%)	47 (4.1%)	42 (4.3%)	122 (4.2%)
41-45-Heavy Silt ...	58 (7.7%)	99 (8.6%)	146 (14.8%)	303 (10.5%)
46-55-Clay ...	461 (60.8%)	739 (64.2%)	764 (77.6%)	1,964 (67.9%)
56-65-Pegassy Clay ...	176 (23.2%)	249 (20.9%)	18 (1.8%)	434 (15.0%)
Above 65-Pegasse ...	23 (3.0%)	6 (0.5%)	...	29 (1.0%)
Total ...	758	1,151	984	2,893

TABLE VIII.

DISTRIBUTION OF SAMPLES ACCORDING TO CONTENT OF SOLUBLE SALTS.

TOPSOILS.

Percentage Soluble Salts.	Demerara, West Coast.	Demerara, East Coast.	Berbice, East Coast.	Total.
0.000%-0.050% ...	718 (94.7%)	955 (83.0%)	776 (79.0%)	2,449 (84.7%)
0.050%-0.100% ...	25 (3.3%)	157 (13.5%)	183 (18.6%)	365 (12.6%)
0.100%-0.200% ...	12 (1.6%)	26 (2.3%)	21 (2.1%)	59 (2.0%)
0.200%-0.300% ...	3 (0.4%)	9 (0.8%)	3 (0.3%)	15 (0.5%)
0.300%-0.500% ...	...	1 (0.1%)	1 (0.1%)	2 (0.1%)
Above 0.500% ...	...	3 (0.3%)	...	3 (0.1%)
Total ...	758	1,151	984	2,893

SUBSOILS.

0.000%-0.050% ...	727 (96.0%)	483 (42.0%)	28 (2.7%)	1,238 (42.8%)
0.050%-0.100% ...	19 (2.5%)	158 (13.7%)	248 (25.2%)	425 (14.7%)
0.100%-0.200% ...	10 (1.3%)	358 (31.1%)	453 (46.0%)	821 (28.4%)
0.200%-0.300% ...	2 (0.2%)	139 (12.1%)	222 (22.6%)	363 (12.6%)
0.300%-0.500% ...	...	13 (1.1%)	30 (3.0%)	43 (1.5%)
Above 0.500% ...	...	...	3 (0.3%)	3 (0.1%)
Total ...	758	1,151	584	2,893

24. The mean annual rainfall experienced during the period 1917-1931 and the mean yield of sugar produced per acre for the period 1927-1931 by the various estates appear in Table IX.

TABLE IX.

	Demerara, West Coast.	Demerara, East Coast.	Berbice, East Coast.
Mean annual rainfall, inches ...	102.37	84.22	72.50
Mean yield of sugar per acre, tons ...	2.162	2.226	2.831

25. Considering first the results obtained with all samples, irrespective of geographical distribution, it will be seen that the normal reaction of 95.0 per cent. of the topsoils is markedly acidic and lies between pH 4.00 and pH 6.00, only 0.4 per cent. of the topsoils are alkaline (normal reaction above pH 7.00). The subsoils are slightly less acidic but only 2.6 per cent. of them are alkaline.

26. Consideration of the tables of exchange reaction leads to similar conclusions. In this case 0.4 per cent. of the topsoils are alkaline (exchange reaction above pH 6.00) while 4.8 per cent. of the subsoils are alkaline.

In both topsoils and subsoils the largest textural class is the clay (index of texture 46-55). Little difference in texture between the topsoils and subsoils is revealed.

The soluble salt content of the topsoils is generally low ; that of the subsoils is markedly higher.

27. Considering now the characteristics of the soils in connection with their geographical distribution, it will be seen that the topsoils and subsoils of the West Coast of Demerara are slightly more acid than those occurring on the East Coast of Demerara while the topsoils and subsoils of the East Coast of Berbice, though still acidic, are markedly less acidic than those occurring on the Demerara coasts.

28. The topsoils and subsoils of the West Coast of Demerara possess, in general, higher indices of texture than those from other parts of the colony. This is due mainly to the greater proportion of cultivated pegasse soils (index of texture above 55) in this area, which accounts also for the slightly heavier texture in the topsoil than in the subsoil. On the East Coast of Demerara and the East Coast of Berbice the subsoil is generally slightly heavier than the topsoil, due, probably, to the downward leaching of the finer particles.

29. The salinity of the topsoils and subsoils of the West Coast of Demerara is low. The topsoils of the East Coast of Demerara and the East Coast of Berbice bear a marked resemblance to each other in regard to their contents of soluble salts. They are, in general, more saline than those of the West Coast of Demerara. Greater differences in salinity are evidenced in the subsoils of the different areas. The subsoils of the East Coast of Demerara are much more saline than those occurring on the West Coast of Demerara. The subsoils of the East Coast of Berbice contain more soluble salts than do those of the East Coast of Demerara.

30. A consideration of the rainfall data presented in Table IX. would suggest that these differences in soil characteristics are in some measure due to the varied rainfall experienced in the three districts. It might be assumed that the heavier precipitation had lead to a reduction in salinity and to an increase in acidity. This may offer a partial explanation of the differences observed. A far more potent factor is probably the amount of erosion experienced at different points on the coast prior to the erection of adequate defences. It seems probably that considerable areas of the front lands of the West and East Coast of Demerara have, in times past, suffered erosion, and that these districts have lost large tracts of their more saline, alkaline soils.

This contention is supported by the fact, that whereas the estates of the West and East Coast of Demerara require the protection of a sea wall, those of Berbice need no artificial defence.

31. Inspection of the figures for the mean yields of sugar per acre in the three districts (Table IX) would suggest that heavier crops are obtained on the more saline, less acidic soils of Berbice which experience a lower rainfall. Probably the most potent factor connected with the larger crops obtained in Berbice is the possession of an adequate and assured supply of irrigation water from pumps on the Canje Creek. The estates of Demerara have to depend on a somewhat uncertain supply of water obtained by gravity from conservancies. The estates of Berbice can flood-fallow their fields immediately they are reaped in the dry season. The estates situated in Demerara must perforce wait until the onset of the rainy season provides a sufficient head of water in the conservancy. It is possible, on the Berbice estates, to irrigate cane fields during the height of the dry season. The

Demerara estates are not so favourably situated. It is fortunate that the Barbice estates, possessing, as they do, a highly saline subsoil, are in a position temporarily to submerge their fields during periods of drought.

32. The estates of the West Coast and East Coast of Demerara present a fairer comparison, for differences in irrigation facilities are largely eliminated. It seems that the slightly less acidic more saline soils of the East Coast of Demerara give somewhat higher yields than the more acidic less saline soils of the West Coast of Demerara. It is possible that the heavier rainfall experienced on the West Coast adversely affects yields. Some support is lent to this suggestion by the fact that there is a definite negative correlation between the yields of sugar per acre and the amount of the previous year's dry season rainfall experienced at Pln. Tuschen de Vrienden, West Coast, Demerara. The correlation coefficient obtained is -0.4972 with a probability of ' P ' ≈ 0.02 . A large proportion of the soils of the West Coast of Demerara are of a pegassy nature and it is not surprising that their yields are somewhat lower than those obtained in other parts of the Colony since the cane experimental work of the past did not apply to pegassy soils. It is only recently that manurial experiments have been commenced on pegassy soil while the preliminary stages of variety experimental work are still confined to the front land soil type.

Changes occurring in the Cane Soils of British Guiana.

33. In paragraph 13 of the report of the division for the year 1931 it was shown that considerable changes had occurred in the cane soils of the Colony during the past twenty-three years. More precise data on this point are now available.

34. The watery extracts of eighty-seven samples of soil examined by the late Sir John Harrison in the year 1908 were all alkaline to litmus paper and therefore probably possessed reaction values above pH 7.0. In the years 1931-32 only twelve topsoils out of a total of 2,893 (0.4 per cent.) had a normal reaction value above pH 7.0. A general figure for the normal reaction of the topsoil of the cultivated cane lands of the Colony, at the present time, is pH 5.02. These figures indicate that in twenty-three years the concentration of hydrogen ions in the topsoils of the Colony's cane lands has increased one hundred-fold.

35. The implications arising from these demonstrated changes in soil reaction must be somewhat confusing to the practical man. At present when soil samples are examined in an advisory capacity they are usually found to be acidic in reaction and dressings of lime-bearing materials are almost invariably recommended. The planter must reason that in the year 1908 cane soils were alkaline and yields were relatively low; in the year 1933 cane soils are markedly acidic and yet during this period yields have progressively increased. (In some measure these larger returns are, of course, due to factory improvements). It seems therefore unreasonable to advocate the application of lime-bearing materials in order to reduce the acidity of the soil. The explanation of the apparent anomaly is that the cane soils of the past owed their alkalinity to the presence of sodium salts. They were, in all probability, difficult to work and doubtless exhibited a tendency to puddle when moist, and to form very hard clods when dry. In the last twenty-three years, the sodium salts have largely disappeared from the cultivated cane lands of the colony, and soil acidity has developed. Improved field behaviour of the soils probably has accompanied this change, and may, to some extent, account for the increased yields. It is likely that this marked increase in soil acidity, which has taken place in a comparatively short space of time, is progressive, and that, if the present system of agriculture is continued, the cane soils of the colony will in the future reach a degree of acidity incompatible with the growth of heavy crops of cane. Adequate dressings of lime-bearing materials should not only arrest the progressive change towards acidity, but should produce a calcium soil with eminently suitable field characteristics. The field trials already established by the Department should yield interesting data on this point.

The Salinity of Cane Soils.

36. In paragraphs 8-10 of the report of the division for 1931, attention was drawn to the presence of accumulation of soluble salts in the colony's cane soils. It is a matter of difficulty to arrive at a figure for the toxic quantity of salts in cane soils. The effect of the presence of soluble salts on cane growth depends not only upon the absolute quantity of soluble salts in the soil but also upon the amount of water present and consequently varies with the texture of the soil. A certain concentration of salts may be innocuous in a clay soil but may be harmful in a sandy soil. Bennett and Allison consider that when the soil salinity exceeds 0.150 per cent. cane growth is adversely affected. Hardy (*Tropical Agriculture*, x, 2, pp. 35-40.) indicates that the toxic limit is reached when the soil contains 0.500 per cent. of salts.

37. During the year the division was consulted with regard to three fields which had been prepared for planting. The area was sampled and the concentration of soluble salts in the soil was found to be high. It was considered that cane growth might be affected. It was suggested that the area should be bed-drilled, flushed periodically with water and that the canes should be irrigated during dry weather. The three fields were resampled some five months later. The percentage of soluble salts found in the two sets of samples appear in Table X.

TABLE X.
PER CENT. SOLUBLE SALTS.

Date sampled.	...	1.4.32.	27.8.32.
Field 1 Topsoil	...	0.159	0.088
Subsoil	...	0.165	0.121
Field 3 Topsoil	...	0.256	0.090
Subsoil	...	0.367	0.289
Field 6 Topsoil	...	0.314	0.099
Subsoil	...	0.407	0.259

38. During the period between the collection of the two sets of samples the area was flushed on five occasions and the incidence of the May-June rains no doubt assisted in decreasing the salinity. In addition both banks were forked after planting and a bed-drill two feet wide by one foot deep was made in the original first bank. The small drains of the fields were dug an extra shovel deep. These operations combined to reduce the salinity of the soil to a marked extent.

The manager reports that :—

“ With more favourable weather conditions growth was satisfactory, but with the advent of the dry season during September to November the canes in the centre of the beds became very withered and growth was retarded. During this period irrigation was carried out four times, the land being completely covered with water for 36 hours.

“ With the onset of the rainy season in December Field No. 1 showed an even growth with a good colour. Fields 2-6 had a good growth and colour about 8 feet from the drains, but the centres of the beds were short and backward.

“ To-day (January 28th, 1933), though the whole block has a good colour and vigorous growth, the centres of the beds still show a backward tendency, No. 1 is a fine looking field through, and I can only account for this by the fact that No. 1, being so much lower than the rest of the block, was heavier flood-fallowed—being most of the time at least $1\frac{1}{2}$ feet under water.”

It should be noted too that the soil of field No. 1 contained on both sampling occasions, less soluble salts than that of the other fields in the block.

Salt in Cane Juice.

39. In an experiment conducted at Sophia Experiment Station samples of juice from parcels of cane collected from thirty-two individual plots were examined as to their content of salts. Immediately after the crop had been reaped composite samples of topsoil and subsoil were carefully collected from each plot. The soluble salt content of the juice samples were determined by electrical means, several being ashed to obtain a factor for converting the figures to ash per cent. juice. No significant correlation was obtained between the ash content of the juice and the salt content of the topsoil. No definite association between the juice purity and the ash content of the juice could be noted. The mean figures for the various determinations appear in Table XI.

TABLE XI.

Ash % juice	...	0.412
Soluble salts % topsoil	...	0.052
Soluble salts % subsoil	...	0.118
Juice purity	...	87.2

The ash content of this laboratory mill juice gives a value lying between those mentioned for Cuban juices, namely 0.999% to 0.066%. (*The Soils of Cuba, Bennett and Allison, p. 299*).

The Flooding of Sugar Cane Lands.

40. In paragraph 15 of the report of the division for 1931, a description was given of some preliminary experiments in connection with the flocculation of representative cane soils by dilute solutions of calcium hydroxide. The experiments have been continued with the view to determining the lowest concentration of lime water compatible with improved texture.

41. A series of soils containing varied amounts of exchangeable soda were shaken with lime water (0.027% CaO) and it was observed that complete flocculation took place in twenty-four hours. Half the clear supernatant liquid was carefully withdrawn from each tube and replaced, at succeeding twenty-four hour periods, by more dilute lime water (0.0027% CaO). The appearance of the suspension was noted at each interval. The results are presented in Table XII.

TABLE XII.

Soil No.	Exchangeable soda mgm. eqs. per cent.	No. of replacements by more dilute lime water.								
		1	2	3	4	5	6	7	8	9
D 256	0.68	NF.	NF.	...	...	...	...	...	...	...
B 31	1.90	NF.	NF.	...	...	...	...	...	...	...
D 267	2.73	F.	F.	F.	F.	F.	F.	F.	F.	F.
D 261	3.71	NF.	NF.	...	...	...	...	...	...	...
B 32	4.32	F.	F.	F.	F.	F.	F.	F.	F.	F.
B 30	4.94	F.	F.	F.	F.	F.	F.	F.	F.	F.
B 50	5.92	F.	F.	F.	F.	F.	F.	F.	F.	F.

N.F.—Denoted not flocculated.
F.—Denoted flocculated.

42. The results have been duplicated and indicate the improvement in texture brought about by treatment of soils containing appreciable amounts of exchangeable soda with dilute lime water. No explanation can at present be offered to account for the anomalous behaviour of soil No. D 261. It should be noted that this minimum concentration of lime water required for flocculation is considerably above the average lime content of the five flooding waters previously mentioned. (Para. 16 Rept. Chem. Division, 1931). It is possible that the lime originally present in these flooding waters had been absorbed by the soil before sampling took place. It is apparent that these experiments do not entirely explain the improvement in soil texture which follows flood-fallowing, for this improvement is noted throughout the cane lands of the colony, yet the soils of the West Coast of Demerara contain little exchangeable soda.

The Composition of Molasses.

43. In Table XV of the report of the division for the previous year the analysis of a typical sample of final molasses from an estate on the East Coast of Demerara was given. During the year two samples of final molasses from an estate on the West Coast of Demerara were examined. The comparable figures at 85° Brix are given in Table XIII.

TABLE XIII.

East Coast, Demerara,			West Coast, Demerara.	
			A	B
Total ash (sulphated)%	...	11.16	7.18	7.81
Potash%	...	3.19	1.66	1.78
Soda %	...	0.17	0.05	...
Potash % total ash	...	28.6	23.1	22.8

44. It will be seen that the ash content of the final molasses from the East Coast factory is considerably higher than that found in the final molasses from the West Coast factory and this finding is not surprising in view of the fact that the soils of the East Coast of Demerara are more saline than those of the West Coast of Demerara. It should be noted that the percentage of potash in the total ash of the East Coast molasses is slightly higher than that of the West Coast molasses.

The Utilisation of Molasses.

45. Attention has been recently devoted to the possible application of final molasses to the cane soils of the colony. Mr. J. F. Williams, A.I.C.T.A., has made some investigations on this point in these laboratories. Theoretical considerations indicate that there are two main directions in which applications of molasses may prove beneficial.

46. In the first case on *pegasse* soils, which are usually deficient in supplies of available potash, the application of molasses may supply the potash requirements of the cane. There is an objection, however, to flood-fallowing pegasse soils with diluted molasses. These soils are highly acidic in reaction and the generation of acid during the fermentation of dilute molasses will probably have a further detrimental effect upon cane growth. Preliminary laboratory experiments indicate that a dressing of ground limestone at the rate of $2\frac{1}{2}$ ton per acre is required to neutralise the acidity generated by the fermentation of dilute molasses applied at the rate of ten ton per acre. This objectionable feature might be circumvented by the application of *undiluted* molasses but such a practice would be fraught with difficulty on the cane-fields of the colony. It may of course be economically possible to recover the potash present in the molasses and so obviate this difficulty.

47. In the second case on *front land* soils which are usually well supplied with available potash, the principal benefit to be expected from the application of final molasses is an increase in the facility with which dressings of lime-bearing materials penetrate the soil. Slaked lime and quick lime are readily soluble in half-diluted final molasses*; on further dilution (in the process of flood fallowing) the lime tends to become carbonated and to separate out in complex combination with sucrose. Whether slaked lime, dissolved in the half diluted molasses and mixed with the flooding water in the centrifugal pump used for flooding, could be distributed uniformly over a field before precipitation took place, requires a test on field scale. On the other hand it may be found more convenient to apply ground limestone to the field before submergence and then to flood-fallow with diluted molasses. It is anticipated that the carbon dioxide evolved during the fermentation of the molasses will render soluble the lime in the form of the bicarbonate and consequently facilitate penetration into soil.

It is not easy to establish approved field trials on flood-fallow questions; it is hoped, however, that these suggestions will be given a trial under estate practice.

* The idea of utilising a solution of slaked lime in diluted molasses for flood-fallowing was communicated to the writer by Prof. F. Hardy.

PADI SOIL INVESTIGATIONS.

48. During the year arrangements were made with the Agricultural Superintendent, Essequibo, to collect soil samples from small representative plots of padi cultivation within his district. These plots, which varied in size from one half acre to one acre, were carefully sampled to a depth of six inches and composite samples of each plot were forwarded to the laboratory for examination. The plots themselves were demarcated and records of the padi yields were obtained. It was hoped that some correlation between the yield and certain soil characteristics would be discovered. Measurements were made, under the direction of the Assistant Chemist, of the soil reaction, the index of texture, the soluble salt content, the organic matter, the nitrogen content, the readily available phosphate, the citric soluble phosphate and potash, the lime requirement and the contents of exchangeable and water-soluble lime, magnesia, potash and soda. No definite correlation was established between the yield of padi and any of the soil characteristics investigated. It is intended to record the yield of padi from these areas over a number of crops.

49. The mean figures and the range for the various soil determinations are shown in Table XIV.

TABLE XIV.

	Essequibo Coast.		Wakenaam Island.	
	Mean.	Range.	Mean.	Range.
Normal reaction pH ...	5.28	6.04-4.87	5.43	6.66-5.03
Exchange reaction pH ...	4.28	5.03-3.94	4.36	5.80-3.88
Index of texture ...	41	68-26	43	49-38
Soluble salts per cent. ...	0.129	0.638-0.058	0.144	0.342-0.044
Organic matter per cent. ...	2.01	3.55-1.33	1.80	3.38-1.07
Nitrogen per cent. ...	0.156	0.344-0.095	0.151	0.186-0.090
Carbon : nitrogen ratio ...	7.50	9.05-5.98	6.95	11.10-5.04
Readily available phosphate p.p.m. ...	54	49-nil	7.9	14-nil
Citric soluble phosphate p.p.m. ...	37	160-4	33	59-12
Citric soluble potash p.p.m. ...	122	267-73	133	213-78
Lime requirement per cent. CaCO_3 ...	0.337	0.520-0.147	0.315	0.520-0.087
Exchangeable and water soluble bases, mgm. eqv. per cent.				
Lime ...	3.48	7.64-1.85	3.18	5.4-2.34
Magnesia ...	8.13	12.31-5.07	8.80	10.79-5.86
Potash ...	0.51	1.16-0.30	0.59	0.91-0.33
Soda ...	1.53	8.78-0.44	2.01	3.65-1.09
Magnesia per cent. total bases ...	59.7	69.5-43.4	60.4	61.0-48.3
Yield 1931 lbs. per acre ...	...	...	3722	4800-2700
Yield 1932 lbs. per acre ...	3090	400-1950	3902	4687-3300

50. Compared with the subsoils of the cane lands of Demerara the organic matter content is high, the carbon : nitrogen ratio is wide, the contents of exchangeable and water soluble lime and magnesia are low, that of potash is high while that of soda is normal.

The content of exchangeable and water soluble magnesia, stated as a percentage of the total bases, is similar to that found in the cane land subsoils.

The content of citric soluble phosphate is, in general, low and it would seem advisable that, when the present high yields show some considerable diminution, phosphatic manures be given a field trial in these areas.

FIELD TRIALS.

Sugar Cane.

51. *Manurial Trials.*—A number of manurial trials with sugar cane have been reaped during the period under review. The detailed results have been incorporated in a bulletin shortly to be published. It seems advisable, however, to give a statement of the present position in this report.

52. There are four main soil conditions which affect the utilisation of fertilisers by sugar cane in British Guiana. They are—

- Flood-fallowed *front land* soil.
- Front land* soil not flood-fallowed (area rapidly decreasing).
- Flood-fallowed *pegasse* soil.
- Pegasse* soil not flood-fallowed.

The preliminary scheme of manurial experiments aimed at the investigation of the nitrogen requirements and the need for lime under these varied soil conditions.

The experiments in some cases were of a complex nature and included dressings of both sulphate of ammonia and lime-bearing materials at different levels of application.

53. The results of the nitrogenous dressings are first considered. Only one experiment under condition (a) has been reaped. The results indicate that 2 cwt. per acre of sulphate of ammonia is the optimum dressing for plant canes. The rate of application to the ratoons might be increased and 4 cwt. per acre may be the best dressing (*vide Agr. Jour. B.G. IV, p. 10*).

The plant cane results of three experiments carried out under condition (b) indicate that 3.5 cwt. to 5 cwt. per acre of sulphate of ammonia is the optimum dressing while for the first ratoons an application at the rate of 3.5 cwt. per acre appears to be more suitable.

No experiments carried out under condition (c) have yet been reaped.

Only one experiment under condition (d) has been reaped.

The plant cane results indicate that a dressing of 6 cwt. per acre of sulphate of ammonia is the optimum.

On unflooded front land soil a slight drop in sucrose quality may be expected in the ratoons with higher dressings of sulphate of ammonia.

54. The results of the field experiments with lime-bearing materials may be summarised in the following manner:—

Under condition (a) the application of ground limestone or slaked lime in the row has no definite effect upon the yield of plant cane.

Under experimental conditions (b) broadcasted dressings of ground limestone produce significant increases in yield of the plant cane crop. Definite residual effects are noted in the first ratoon crop. There is evidence that heavy dressings of ground limestone have an *adverse* effect on the juice purity of the plants and on the juice purity and glucose ratio of first ratoons.

No experiments with lime-bearing materials have been carried out under condition (c).

In the two experiments with lime-bearing materials carried out under condition (d) it appears that dressings, applied in the row, at the rate of one ton per acre give definite increase in yield in the plant cane crop. Heavier dressings do not appear to give further increases in yield.

55. In the results of the liming trials must of course be interpreted with due reserve for it is unlikely that the maximum effects will be shown during the first year after application.

Two experiments have been laid down, the one on *pegasse* soil, the other on *front land* soil, to compare the effects of dressings of ground limestone and of slaked lime. In neither experiment could any differences in yield of plant cane between the two sources of lime be detected. In both experiments the ground limestone was cheaper and less expensive to apply. Several theoretical and practical reasons have been advanced in favour of the use of ground limestone (*vide Ministry of Agriculture and Fisheries Bull. No. 35, Agr. Jour. B.G., Vol. II, p. 61.*). On the other hand no valid practical or theoretical reason has been advanced in favour of the use of slaked lime on the colony's cane lands.

56. In two experiments involving graded dressings of sulphate of ammonia and of ground limestone, an interaction between the two fertilisers is apparent. It

seems that, in the presence of the higher dressings of ground limestone, the heavier dressings of sulphate of ammonia are less effective.

57. The findings of these preliminary field experiments fall into line with the results of laboratory investigations. In the report of the division for the previous year it was shown that the ammonia contents of the soil increased, on the average, to the extent of 2.5 cwt. per acre of sulphate of ammonia consequent upon flood-fallowing. The field experiments on flooded and unflooded front land soils indicate that the nitrogen requirements of plant cane on flood-fallowed soil are smaller than those obtaining on unflooded soil by an amount approximately equivalent to 2.5 cwt. per acre of sulphate of ammonia.

58. Field experiments indicate that the nitrogen requirements of plant cane on pegasse soil are higher than those found upon front land soil. The carbon nitrogen ratio of the organic matter of the former soil type is wide, that of the latter soil type is narrow. It is to be expected therefore that the nitrogen requirements of the pegasse soil would be greater.

This preliminary scheme of field experiments indicates that, under the varied conditions noted, the lime and nitrogen requirements of sugar cane differ considerably.

59. It is of course impossible to advocate changes in the manurial practice based on the results of single experiments. Fortunately, Messrs. Booker Bros., McConnell & Co., Ltd., and Imperial Chemical Industries, Ltd., have jointly offered to contribute towards the establishment of a chain of field experiments involving graded dressings of sulphate of ammonia. Eleven trials have been distributed throughout the cane lands of the colony and the plant cane results should be available in the spring of 1934. By this means it will be possible to construct yield curves for the various soil conditions which should enable planters to arrive at the correct rate of application of sulphate of ammonia when prices of sugar and fertilizer vary.

60. Experience with the application of phosphatic and potassic manures to the colony's cane soils in their present condition does not permit the statement of definite opinions. There are some indications that dressings of superphosphate of lime are superior to equivalent dressings of ground rock phosphate.

Rice.

61. *Manurial Trials*.—One of the two large survey manurial experiments with padi, discussed in paragraph 22 of the 1931 report of the division, was replanted in order to assess any residual effects of the various manures. The field work was supervised by the Plant Breeder.

East Demerara Trial.—Statistical analysis of the padi yields indicated that only one treatment, superphosphate of lime, gave a significant residual effect. The results appear in Table XV:—

TABLE XV.

	Lbs. Padi per acre.	Per cent. of mean.
With superphosphate	✓ 2,955	101.6
Without superphosphate	... 2,860	98.3
Difference	... 95	3.3
Mean	... 2,908	100.0
S.E. of mean	... 28	0.96
'Z' value for effect of superphosphate on yield		0.8655
'Z' value required for P 0.05		0.6933

62. In the original experiment the dressing of superphosphate gave an increased yield of 154 lbs. per acre. In two years, therefore, this dressing was responsible for an increase of 249 lbs. padi per acre. Under these circumstances the application of phosphatic manures to padi lands is not an economic proposition.

63. It was pointed out in para. 25 of the 1931 report that although padi yields in the East Demerara experimental area had decreased gradually in recent years yet no combination of fertilisers used in the experiment brought about paying increases in yield. It was suggested that possibly the preponderance of magnesium among the exchangeable bases of the soil had a depressing effect upon yields. The examination of carefully collected composite soil samples from areas where reliable yield figures could be obtained indicated that heavy yields of 4,800 lbs. padi per acre were produced on soils containing a preponderance of exchangeable magnesia. It seems probable therefore that some other growth-inhibiting factor governs the effect of added fertilisers on padi soils.

The yields from the two experimental areas, discussed in the previous report, are high in comparison with the figures obtained in other padi producing tropical colonies, and this fact probably furnishes some explanation for the small increases obtained in these trials.

64. The results of recent padi manurial trials in other tropical countries are compared in Table XVI. with those obtained in the British Guiana trials under consideration. The table includes the yield in lbs. per acre of the unmanured plots, the highest yield in lbs. per acre obtained on the manured plots, and the yield of the manured plots stated as a percentage of the yield of the control plot. From these results it has been possible to derive an equation which permits the calculation of the expected increase on manuring from the yield of the unmanured area. The calculated increases also appear in Table XVI.

TABLE XVI.

Country.	Yield lbs. per acre.		Manured x 100.	Calculated
	Unmanured.	Manured.	Unmanured.	Increase.
Ceylon (1)	270	585	216.7	...
Ceylon (1)	717	1,565	218.1	234.7
Lower Burma (4)	1,250	2,733	218.3	189.3
Ceylon (1)	1,402	2,732	194.8	179.9
F.M.S. and S.S. (5)	1,424	2,801	197.0	178.6
Lower Burma (4)	1,533	2,650	172.9	172.5
F.M.S. and S.S. (5)	1,800	2,080	115.6	159.5
Hawaii (6)	2,080	2,892	139.0	147.7
Ceylon (1)	2,568	3,102	120.8	130.3
Hawaii (6)	2,762	3,835	138.8	124.5
Ceylon (2)	2,842	3,847	135.3	122.0
British Guiana (3)	2,990	3,144	105.2	117.9
Ceylon (5)	3,039	3,356	108.8	115.3
Ceylon (5)	3,110	3,670	118.0	114.7
British Guiana	3,960	3,960	100.0	(94.9)

References—

- (1) Manurial experiments with rice. *III Trop. Agriculturist*, LXXVI, 1931, p. 70-83.
- (2) Green manuring of paddy. *Trop. Agriculturist*, LXXV, 1932, p. 7.
- (3) Manurial experiments with rice. *II Trop. Agriculturist*, LXXIII, 1929, p. 259.
- (4) *Agr. Jour. India*, XXIII, V, p. 364.
- (5) *Malayan Agric. Journal*, XIX, p. 592.
- (6) *The Use of Fertilisers*. Jacob & Coyle, 1931, p. 60.

65. It is to be expected that there would be a definite connection between the yield from the unmanured plots and the yield obtained on manuring (stated as a percentage of the control yield.) If the common logarithms of the yields (in lbs. per acre) from the control plots are compared with the percentage increases in yield a highly significant correlation coefficient, $r = -0.9028$, is obtained.

66. In order to predict from the yields of the control plot the increase to be expected on manuring, a regression equation, involving the percentage increase and the common logarithm of the yield (lbs. per acre) of the control plot, has been calculated.

The regression coefficient of percentage increase on the common logarithm of the control plot yield is :—

$$b = -188.4 \pm 0.124.$$

The regression equation is :—

$$\text{Percentage increase} = 148.8 - 188.4 (\log_{10} \text{ control yield} - 3.312).$$

In deriving the equation, the results of the Ceylon experiment at the head of Table XV. were not included for it was considered that a soil yielding 270 lbs. padi per acre was not normal. The experiments, with the exception of the two Hawaiian trials, possessed evidence of statistical significance.

It is probable, had more results been available, that a better curve might be obtained. On the other hand the fitting of a second order polynomial such as :—

$$\text{Percentage increase} = 148.8 - 191.08 (\log_{10} \text{ control yield} - 3.312) - 20.633. (\log_{10} \text{ control yield} - 3.312)^2$$

does not greatly improve the estimate.

The equation should be of use in predicting, from the given yield of a field, the probable increase to be obtained on manuring. Thus in British Guiana, with the present prices of fertiliser and padi, it would appear to be an unprofitable undertaking to manure any area which gives a yield of 2,500 lbs. (18 bags) or over per acre. The experimental areas at the disposal of the Department regularly produce yields higher than this critical value.

67. To summarise the position it may be said that the soil of the experimental areas appears to be too rich in supplies of plant nutrients to benefit by the applications of fertilisers. On the other hand a gradual decrease in yield has been noted on the Georgetown experimental field for some years. This decrease may be due to the increasing importance of some growth-inhibiting factor.

68. During the preparation of this section of the report a very interesting publication on the subject of padi experiments in Malaya, 1931-32, was received (*Malayan Agr. Jour.*, XX No. 12). From the result of manurial trials in that colony it is concluded that the results—

“Tend to show that each station, for a particular season, has a maximum
“beyond which manuring with artificial fertilizers cannot increase the
“crop.”

“Whatever the cause, it seems useless to continue on orthodox lines—previous experiments and those of the last two seasons all show that no
“increase beyond the “bar” will be obtained by such methods. We have
“now to enquire whether manures will aid the soil (if aid is needed) in
“supporting more plants per unit area, *i.e.* to test the possibility of obtaining greatly increased yields by manuring and closer planting. There is
“the greater possibility of this as in Italy, yields of 800 gantang per acre
“are obtained with planting distances of 8 ins. x 8 ins.”

69. The Department is confronted with a similar problem in British Guiana. The average yield per acre obtained in Spain is 5,146 lbs., yet applications of artificial fertilisers in all combinations to two areas in this colony yielding 2,900 lbs., and 3,960 lbs. padi per acre failed to produce any marked increase in yields. The planting distance employed in these two trials was similar to that used in Italy, namely, 8 ins. x 8 ins.

It is possible, as suggested by Belgrave (*loc. cit.*) that closer planting, accompanied by heavy manuring, may produce large increases in yield and it is proposed to investigate this point during the coming year.

It is possible that some alteration in the customary method of field selection might lead to more promising results. It is usual in variety work to compare different strains on unmanured land or on an area receiving a basal dressing of fertiliser. It is assumed that the particular strain giving the heaviest yield under these conditions is worthy of further extension. It may be wiser in future to practice selection with the view of obtaining a strain, which among other qualities, possesses a marked propensity towards the efficient utilisation of heavy dressings of fertilisers.

Sweet Potatoes.

70. *Manurial Trials.*—Reference was made in the previous report of the division (para. 26) to a manurial trial with sweet potatoes laid down by the Agricultural Superintendent, Berbice. The trial consisted of dressings of sulphate of ammonia, sulphate of potash and superphosphate, singly and in every combination.

The results of the experiment appeared in the report of the Agricultural Superintendent, Berbice, for 1931, (para 10) but for convenience are reproduced here.

TABLE XVII.

	Total Weight lbs. per acre.	Marketable Potatoes lbs. per acre.	Unmarketable Potatoes lbs. per acre.	No. of Marketable Potatoes per lb.	Per cent. Marketable Potatoes.
3 cwt. per acre Sulphate of Ammonia ...	6,697	3,967	2,730	2.50	59.2
No Sulphate of Ammonia ...	3,063	1,342	1,721	3.43	43.8
Increase ...	3,634	2,625	1,009	...	...
S.E. of mean ...	264	181	...	0.21	2.07
Mean ...	4,880	2,654	2,226	2.79	52.07

71. The dressings of sulphate of potash and of superphosphate had no definite effect upon the yield or upon size of tubers.

Composite soil samples of the area, collected by the Agricultural Superintendent, were submitted to laboratory examination. The results appear in Table XVIII.

TABLE XVIII.

Sample No.	B. 46.	B. 47.
Depth ...	0-1 ft.	1 ft.—2 ft.
Normal reaction pH ...	5.07	4.21
Exchange reaction pH ...	3.86	3.51
Index of texture ...	39	46
Organic matter % ...	0.86	0.79
Nitrogen % ...	0.086	0.077
Carbon : nitrogen ratio ...	5.83	5.99
Soluble salts % ...	0.051	0.178
Rate of solution ...	35	12
Lime requirement % CaCO ₃ ...	0.374	0.747
Readily soluble phosphate p.p.m. ...	22	23
Citric soluble phosphate p.p.m. ...	20	23
Citric soluble potash p.p.m. ...	117	70
Exchangeable and water soluble bases mgm. eqs. per cent.		
Lime ...	3.44	3.69
Magnesia ...	4.98	5.61
Potash ...	0.43	0.43
Soda ...	1.03	2.60
Ratio MgO/CaO ...	1.45	1.52

The topsoil is a highly acidic fine silt overlying a highly acidic clay. The organic matter content is low and the carbon : nitrogen ratio is narrow. Both topsoil and subsoil contain a considerable amount of soluble salts. The content of available potash is high, that of available phosphate is low. It is surprising, under these circumstances, that no response to applications of superphosphate was obtained in this trial.

72. It was considered, at the time of this first experiment, that a smaller application of sulphate of ammonia might have proved more economic. The first experiment, which was in the nature of a survey trial, was therefore supported on an adjoining piece of land by a second experiment containing varied broadcasted dressings of sulphate of ammonia.

73. The Agricultural Superintendent, Berbice, who was responsible for the field work, forwarded the following yield figures which were submitted to statistical examination. The results appear in Table XIX.

TABLE XIX.

Sulphate of Ammonia.			Total yield lbs. per acre.	Marketable Potatoes lbs. per acre.	No. of Marketable Potatoes per acre.	No. of Marketable Potatoes per lb.	Percentage of Marketable Potatoes.
Nil	...	...	1,673	245	547	2.24	14.6
1 cwt. per acre	...	...	2,942	775	2,053	2.64	26.4
2 cwt. per acre	...	...	4,208	1,548	3,730	2.41	36.8
3 cwt. per acre	...	...	4,890	1,917	4,173	2.18	39.2
Mean	...	...	3,428	1,119	2,626	2.35	32.6
S.E. of mean	...	...	572	130	317	...	...
Significant difference	...	...	1,678	380	918	...	...
'Z' value obtained	...	...	0.9097	1.656	1.6682	...	...

'Z' value required for $P=0.01$ = 0.8138.

74. In both trials applications of sulphate of ammonia improved the total yield the yield and number of marketable potatoes, and the size of the individual tubers. Both experimental areas, however, gave yields below the average and this is attributed by the Agricultural Superintendent to the effect of ill-distributed rainfall in the case of the second experiment.

The yields in the second experiment were much lower than those obtained in the first experiment. The percentage of marketable potatoes was much lower but the individual marketable tubers were, in general, larger in the second experiment than in the first.

The residual error in the second experiment was high. Had a normal variation obtained over the experimental site it is probable that a dressing of 3 cwt. per acre sulphate of ammonia would have proved the optimum amount. Under the conditions of the experiments it appears advisable to advocate the application of sulphate of ammonia at the rate of 2 cwt. per acre.

75. The second experiment took the form of three 4×4 latin squares and the results demonstrated considerable difference in yield from the three separate squares. Composite samples of soil from each of the three squares were obtained by the Agricultural Superintendent, Berbice, and these samples are being examined in the laboratory. It is hoped, by these means, to throw some light on the cause of the low yields.

ACKNOWLEDGMENTS.

76. It is a pleasure to acknowledge the considerable help rendered during the year by Mr. C. L. C. Bourne and Mr. L. A. Robinson.

R. R. FOLLETT-SMITH,
Chemist-Ecologist.

March 13, 1933.

DEPARTMENT OF AGRICULTURE.

REPORT OF THE BOTANICAL AND MYCOLOGICAL DIVISION
FOR THE YEAR 1932.

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REPORT OF THE BOTANICAL AND MYCOLOGICAL DIVISION FOR THE YEAR 1932.

STAFF.

E. B. Martyn, B.A. (Oxon. et Cantab.)—Botanist and Mycologist.
N. Persaud—Laboratory Assistant.

DISEASES OF MAJOR CROPS.

Sugar Cane.

Root Diseases.—There was no abnormal occurrence of this disease reported during the year. Together with several minor unhealthy manifestations of cane occurring in this Colony, it is ascribed to soil conditions. Previously an excess of Magnesium in the soil has been suggested as the cause of the disease, and dressings of Lime to rectify the Magnesium Lime ratio have been advised as a curative treatment. In a small experiment, described in the report for 1931, an application of lime had no apparent effect. At the same time, it is noticed that flooding of cane fields is usually beneficial with regard to this disease. Such observations rather tend to suggest that an excess, not of Magnesium alone, but of soluble salts of any nature in the soil, may account for the symptoms of the disease. Any steps therefore that can be taken to obviate such a concentration of salts in the soil, such as the deepening of drainage, and consequent encouragement of increased movement of the water table, should tend to lessen the occurrence of the disease.

2. *Mosaic*.—A further visit was paid to Pln. Waterloo, Nickerie, to observe the effect of Mosaic disease on the variety D. 625, which has been infected on portions of the estate for nearly 10 years. Despite the fact that from stress of circumstances infected fields have had to be continued to fourth and fifth ratoons, and 50 to 60 per cent. mosaic infection is recorded for them, good yields have been maintained, and the slight decreases noted are no more than would be expected as a result of continuous cropping. The quality of the juice from these fields is only slightly affected. Finally, despite the inability to carry out control measures, the spread of the disease from the worst infected areas is very slow and spasmodic. It would appear therefore that D. 625 is definitely resistant to mosaic, and while exhibiting, when infected, the typical chlorosis and mottling symptoms of the leaves, is not functionally affected to any great extent.

Rice.

3. *Man Rice*.—The fungus associated with this disease has been identified at the Imperial Mycological Institute as a strain of *Fusarium moniliforme*. Spore measurements carried out by the writer gave the following figures:—Macrospores 2.4 septate, majority 3 septate, 26.4μ — 49.5μ $\times$ 3.3μ — 4.9μ . Microspores non-septate, 6.6μ — 13.2μ $\times$ 3.3μ — 4.9μ . These measurements agree fairly well with those given for the causative organism of a similar disease reported in Madras, and for *Lisea fujikuroi*, which causes the BAKANÆ disease of rice in Japan, the symptoms of which also have much in common with 'Man Rice.' These similar diseases in India and Japan however are of a more serious nature than 'Man Rice.' The local fungus also differs from that causing BAKANÆ disease, in that no Perithecial stage has been found associated with 'Man Rice,' nor has this stage been obtained in culture.

4. In connection with the occurrence of 'Man Rice' in the Colony, it may be noted that in a manurial trial at the Georgetown Experiment Station, where a count of diseased plants was made, the addition of ground limestone to the soil at the rate of 1 ton per acre was found to have caused a statistically significant increase in the number of infected plants.

5. *Disease of flowering heads of Rice*.—Flowering heads of Demerara Creole, ripening at the Experiment Station, Georgetown, out of season, in July and August, were affected by a spotting on the paleae, which eventually turned brown or black, the whole spikelet drying up. The leaves of the plants were unaffected, but in some cases the sheathing leaf from which the inflorescence emerged showed dark brown blotches near the point of emergence of the flowering head, the spikelets of which were found to be mostly shrivelled and brown. A species of *Pusarium* was found associated with these latter symptoms, and two other fungi, *Acrothecium lunatum* and *Clasterosporium punctiforme* were isolated from the diseased inflorescences. (*A. lunatum* has been isolated in association with a similar disease of rice inflorescences on the Gold Coast).

6. The disease appeared to be one of a minor nature which had assumed rather unusual proportions on plants flowering during the wet weather. It was most apparent in beds lying rather under the shade of the sheltering belt of bamboos, and along the line of old drains where vegetative growth was developed to the greatest extent.

7. *Blast*.—*Piricularia oryzae* occurred on a few plants of "Blue Stick" rice at the Experiment Station in August.

Coffee.

8. *Sclerotium Disease*.—The seasonal outbreak of the disease in the North West District became fairly prominent in October and was reported as being bad in one or two localities. It does not, however, appear to have been in any way serious.

9. *Phloem necrosis*.—Material taken from chlorotic and wilting Liberian coffee bushes on the West Bank, Demerara, and examined by Dr. Stahel in Surinam, showed *Phloem necrosis* to be present in an acute form, accounting for the sudden collapse of apparently healthy bushes.

10. The disease is of a serious nature in Surinam, where it has been investigated in detail. It is attributed there to a small flagellate, a species of *Phytomonas*, which is found in the affected sieve tubes. The method of transmission of the disease, and the alternative hosts of the causal organism are at present uncertain, and until more is known it is difficult to devise suitable methods of control.

11. In this Colony, until recently, no serious outbreak of the disease had been recorded, and only isolated bushes were affected. In September, however, a more extended outbreak of what is undoubtedly the same disease occurred on one or two grants in the North West District. The worst affected area was in a somewhat neglected condition, which may have been a contributory cause. No subsequent outbreaks were reported.

12. In regard to this outbreak, it was advised that isolated diseased bushes be uprooted and burnt, and where a field was badly affected that it be cut off from its neighbours if possible by deep water filled trenches, and subjected to intermittent flooding. These precautions are based upon tentative control measures which have been tried in Surinam.

DISEASES OF MINOR CROPS.

Vegetables.

13. *Root knot, Heterodera radicum* (Greef.) Muller.—Tomatoes and Potatoes grown in the kitchen garden of the Forestry Department's Station at H.M.P.S., Mazaruni, were found to be seriously affected by this disease, which is due to a nematode or eel worm that invades the roots of the plants attacked. Other vegetables also, were affected to a lesser degree.

14. Hot water treatment of the soil was difficult to carry out, and finally proved ineffective. Subsequently, the growing of lettuce as a trap crop, which is

dug up and destroyed when infected, has been tried, together with the use of fresh soil, taken from pits 5 feet deep in an unaffected area. Coconut leaves were burnt on the soil before use.

15. The soil at the Settlement is of a sandy nature, and this is the first time that this disease has been reported in the Colony. In the locality in question it has become wide spread. Should it appear else where on the sandy soils of the interior, it might well prove a very serious factor with regard to the cultivation of vegetable crops by farmers.

Sweet Potatoes.

16. *White Rust* (*Cystopus ipomoeae-pandurane* (Schwein Stev. and Swing.) occurred on the leaves of the following varieties at Sub-Station Cecelia; Red Nut (Barbados); Red Nut (Trinidad); Carolina Lea; Brooks Gem; Six Weeks. The disease was only present to a small extent.

Tomatoes.

17. *Blossom End Rot*, occurred at Pln. Henrietta on the varieties Early Market, Bonny Best, Marglobe and John Baer.

Papaws.

18. *Curly Leaf*.—A disease of this nature appeared on some seedlings of a dwarf variety of papaw received from the North West District, which were basketed in the nursery. It spread to some adjacent basketed seedlings of another variety. Affected plants were destroyed, the seedlings spaced further apart, and subsequent cases of the disease 'rogued' out. These steps effectually checked the spread of the disease.

Breadfruit.

19. *Fruit rot*.—During the wet season, some diseased fruits were received from Arcadia Village, East Bank. A brown rot, beginning at the distal end of the fruit, spread gradually over the whole of it. Excessive humidity appeared to be the main factor concerned.

Pineapples.

20. *Black Eye*.—Instances of this disease have been reported from the Pineapple Company's cultivation on the Demerara River. Should it become prevalent there, it is likely to form a serious menace to the extension of this cultivation.

MISCELLANEOUS.

List of Plant Diseases.

21. A revised list of the diseases of Economic Plants in British Guiana as at present known was prepared and forwarded to Kew, for subsequent publication in the Kew Bulletin, in accordance with similar lists from other colonies.

Imperial Mycological Institute.

22. A number of cultures of fungi have been forwarded to the Institute, to whom thanks are due for determinations received and for notes concerning some of the specimens.

Apparatus.

23. A small electric autoclave was obtained during the year, which greatly facilitates the preparation of culture media.

Exhibits.

24. An exhibit of Mosaic disease of tobacco and tomatoes, and of Blossom End Rot of tomatoes, together with explanatory notes, and suggestions as to control measures, was prepared for the Workers League Exhibition in October.

BOTANICAL GARDENS.

Rice Grass.

25. The experimental planting of this imported grass (*Spartina Townsendii*) has been extended. On the original small plot out on the foreshore at Lilliendaal, the grass had formed a continuous mat over the plot (about 6' x 6') and was beginning to spread outside. The close cropped appearance of the grass suggested that goats had been able to reach it at certain states of the tide and had been grazing it. The grass is a darker green and of a much more succulent nature than the local species of 'Rice Grass' (*S. brasiliensis*) which covers the greater part of the newly formed foreshore east of Georgetown.

26. Plants of *S. Townsendii* from this small initial plot were dug up, and two small new colonies were planted, one at the outer edge of the muddy foreshore east of Kitty, and one further up the coast, on the mud near Good Hope Koker Channel. Some nine plants were set out at each point in September, the majority of which became rooted, and were beginning to send up fresh shoots by the end of the year.

27. In connection with the spread of the local Rice Grass (*S. brasiliensis*), notes and observations were made of the present condition of the vegetation on the foreshore between Georgetown and Buxton, and a short paper on the subject was submitted for publication in the Journal of Ecology.

Pastures.

28. A survey was made of typical pastures on the coastland in Berbice Demerara and Essequibo, and a report submitted on the pastures and pasture grasses in these areas, together with some notes on the pastures in the interior compiled from the information available. This report, in a condensed form, was published in 'Herbage Extracts.'

29. The necessity for the fencing and controlled stocking of pastures, before any further steps towards improvement could be made, was stressed.

Citrus.

30. A visit was paid to the North West District to inspect the progress of the citrus cultivation at Hosororo, and a report submitted.

31. Several localities in the neighbourhood of Georgetown were visited with a view to finding good seedling citrus trees, from which budwood might be selected with a view to supplying local markets.

Fish Poisons.

32. The experimental cultivation of fish poisons, in particular Haiari, in the North West District, were inspected and reported on. As regards the Haiari (*Lonchocarpus* sp.) the main factors that have become apparent to date are :—(a) That White Haiari grows more vigorously than Black, and (b) that the growth of both types is better in the open than under shade, or at any rate the rather heavy shade over the experimental areas. Also, the growth on sandy soils at Wauna is rather better than on the laterite at Hosororo.

33. The plantings of Yarroconalli (*Tephrosia toxicaria*) had failed almost completely, and it appears that this plant would only become established if planted in beds and given careful attention. The Haiari on the other hand is easily established from cuttings put in the ground after clearing the bush, and needs little attention beyond periodic weeding.

JENMAN HERBARIUM.

34. Routine work has been carried out, and the remounting of specimens is being slowly continued as opportunity allows. The whole of the Gramineae have been dealt with during the year. The preparation of the card index of the contents of the Herbarium is being carried out in conjunction with the remounting of specimens.

35. Specimens of leaf, fruit, and flowers, of some 18 species of palms cultivated in the Gardens have been collected, and photographs taken showing the general habit of these. The specimens have been assigned hitherto to the genera *Attalea*, *Euterpe* and *Sabal*, and it is hoped to submit them shortly for expert examination, in order to bring up to date the nomenclature of these palms in the Gardens.

36. Seeds, fruits, etc., have been collected when available, and despatched to fulfil the requests of various correspondents and other Botanic Gardens, etc. A number of valuable additions to our own collection have been received in exchange.

37. Some 500 unnamed specimens of plants collected by Jenman, Bartlett and others were forwarded to Kew for determination. Determinations were received from Kew of a number of plants collected in 1931 on the Cuyuni River.

38. A visit was paid to the Herbarium and Botanic Gardens in February by Dr. Fairchild of the U.S. Department of Agriculture and a party of American scientists.

E. B. MARTYN,
Botanist and Mycologist.

February 4, 1933.

DEPARTMENT OF AGRICULTURE.

REPORT ON THE BOTANIC GARDENS FOR THE YEAR 1932.

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REPORT ON THE BOTANIC GARDENS FOR THE YEAR 1932.

STAFF.

E. B. Martyn, B.A. (Oxon. et Cantab.)	—Superintendent of Gardens.
H. A. Cole	—Horticultural Assistant.
G. L. Leitch	—Clerical Assistant.
M. Sheriff	—Nursery Foreman.

GENERAL.

The weather during the year was not particularly favourable to the Gardens, a very prolonged wet season being followed almost immediately by over three months continual dry weather, broken only by one heavy storm at the end of October. Despite this, however, and the fact that expenditure has had to be further curtailed, the condition of the Gardens has been maintained and reflects credit on the efforts of the working staff.

2. A number of new trees and shrubs that have been obtained in the last year or so have been planted out and should prove valuable additions.

The plan of the Gardens and index of major plants was completed.

3. The following table shows the amounts spent under the various votes concerned :—

	Vote,	Expenditure.
Botanic Gardens, Maintenance ...	\$ 4,500 00	\$ 4,486 04
Purchase, Production and Distribution of seed	3,000 00	2,998 91
Government House and Public Buildings	1,400 00	1,393 45

FRONT GARDENS.

4. The flower beds and borders have been kept planted with the usual variety of annual and perennial herbaceous plants. The Zinnias, as before, have proved themselves one of the best suited flowers for local conditions, and the double varieties have shown up most effectively in some of the borders. A purple variety of *Portulacca* and a pink *Cosmos* have been new introductions. *Clerodendron jallax* has been re-established and has proved quite successful. The oval bed in the avenue has been bordered with blue *Plumbago*. Attempts to extend the pink *Plumbago*, however, were not so successful.

5. The avenue of *Borassus* palms behind the D'Urban Park grandstand has been interplanted with *Cassia multijuga* and a dwarf *Hackia* (*Tecoma* sp.), which should look well when they mature. Several plants of *Cassia fistula*, which has proved difficult to establish in the Gardens hitherto, have been bedded out on prepared mounds in selected spots, chosen as being well drained. It is hoped that this will enable them to develop properly.

6. The beds surrounding the front office have been occupied for the greater part of the year by Dahlias, which despite a number of petty thefts, have proved an attractive surrounding to the building. The front office itself was largely rebuilt and entirely repainted by the Public Works Department at the beginning of the year.

7. The collection of *Hibiscus* varieties in the southern section has become well established, and together with the *Canna* beds, enhances the beauty of this part of the Gardens. The path south-east of the *Hibiscus* bed has been bordered on each side by *Oleanders*.

8. The attempt to establish some new clumps of the aquatic palm *Nipa fruticans* at the eastern end of the lakes was repeated early in the year, and the germinating seedlings set out seem to have taken firm root, though growing very slowly.

9. New plants set out this year include *Carissa grandiflora*, *Cassia surratensis*, *Myrciylon senticosum*, *Pithecolitium brevifolium*, *Schinus terebinthifolius* and *Stephanus spines* obtained from Dr. Fairchild of the U.S. Department of Agriculture, who with other members of Mr. Allison V. Armour's expenditure visited the Gardens early in the year and received a number of local specimens in exchange. Plants of *Sapindus inaequalis*, *Conjua tomentosa*, *Acaria sphaerocephala*, *Spiraea Reversum* and *Crossandra undulata*, received from the Agricultural Department of Dominica, have also been welcome additions to the Gardens.

10. Bordering the path leading to the No. 1 island a number of plants of *Erythrina Crista-Galli* have been placed and are for the most part promising, though one or two were lost during the dry weather. Behind the bandstand two trees of *Araucaria Bidwilli* were set out.

11. Early in July it was noticed that specimens of *Corypha elata* in the southern section, east of the No. 1 Lake, and behind the Director of Agriculture's house, were sending up flower spikes. In due course fruit was set, and these monocarpic palms will die. At the end of the year, however, the fruits were still maturing, though all the leaves had died.

12. In addition to the usual removal of bird vine, etc., from trees and bushes, a more extensive clearance of some of the rather overgrown sections was undertaken. In particular the islands, and some of the beds surrounding the lakes, which were overgrown by a meaningless tangle of bush, were cleared early in the year. All superfluous climbers, self-sown plants and matted undergrowth were removed, exposing the original specimens planted there, many of which had become entirely lost to view, and leaving a number of open beds in which flowering shrubs, etc., were planted. As these latter develop, the improvement effected should be marked.

13. Two heaps of earth were burnt in October, and a number of the paths in the southern section, the condition of which had become very bad, were resurfaced. As far as the supply of earth would allow, the worst places on the paths in the northern section were patched. In order to obtain wood for these heaps, many of the larger trees in the Lamaha border had to be cut down, and it is to be feared that in the near future it may be difficult to obtain fuel for burning earth from the Gardens' own resources.

14. A further improvement to the southern section was effected by cutting two drains out to the side-line, in order to take off the surface water which always collects to a depth of several inches over the roads and paths in this area after heavy rain.

15. All the bridges have been overhauled and repaired, new timber being put in where necessary and handrails provided where they were missing. These latter greatly improve the appearance of the bridges.

16. During the dry weather at the end of the year the level of the lakes fell considerably and the maintenance of water in the irrigation channels proved a very difficult matter. The main intake channel from the No. 1 lake had to be 'stopped off' and water baled over the top with a 'make-shift' scoop worked by two men. As an experiment, a pump was obtained from the Public Works Department and utilised to pump water into the irrigation trenches. The cost of working the pump proved too high under the circumstances, but if the Gardens owned their own pump, these could probably be reduced. If the irrigation trenches were divided into sections with suitably placed 'stop offs,' to control the

flow of the water, the use of a pump would be most advantageous during the dry weather. As it was, a small hand pump, which was used to pump water from the irrigation trenches on to the beds through a short length of hose, proved a great improvement over the cumbersome method of watering with cans. This pump only had to be relinquished when the level of water in the trenches became too low.

PARK LANDS.

17. Owing to the curtailment of funds available for the upkeep of the Gardens, the two serpentine roads were closed to vehicular traffic by permanent barriers placed at each end.

18. The vote providing for the cutting of grass for Police horses having been suspended, this operation was carried out by Prison labour. In addition a limited number of persons were permitted to cut grass in the Gardens, in return for which privilege, the majority provided periodic loads of cow manure.

19. Two trees of *Ficus religiosa* in the lower section of the avenue and a *Ficus Benjamina* near the top, died during the year and were cut out. One of the old Oronoques just above the iron bridge fell in November and destroyed one or two small trees near it as it crashed. Several branches from the old Oronoque trees fell during the year, and as a precaution one or two of these trees with limbs overhanging the avenue were pruned.

20. The loss of the abovementioned trees occasioned a number of gaps in the avenue and in addition there were several empty spaces resulting from former casualties, particularly in the line of trees outside the avenue trenches. Mounds having been previously prepared, with the December rains an extensive planting was carried out to fill these gaps, the trees set out including several new specimens. A number of palms too were planted in the more shady places.

21. The plants put in included; *Arenga undulatifolia* (from Singapore), *Bixa orellana* (Annatto), *Brunfelsia* sp., *Casuarina equisetifolia*, *Cordia* sp., *Elaeis guineensis* (African Oil Palm), *Euterpe ventricosa*, *Ficus platyphylla*, *Guaiacum officinale* (Lignum Vitae), *Hydnocarpus venenata*, *Kopsia arborea*, *Korthalsia grandis* (from Singapore), *Lysidice Rhodostegia*, *Monodora grandiflora*, *Myrciaria edulis*, *Peltophorum ferrugineum*, *Petrea erecta*, *Pinanga kuhlii*, *Pithecolobium saman* (Saman) *Poinciana regia* (Flamboyante), *Pritchardia pacifica*, *Spathodea campanulata* (Tulip tree), *Stevensonia grandifolia*, and *Strychnos spinosa* (Kaffir orange).

22. Additional plantings during the year were *Ficus mysorensis* and *Tectona grandis* (Teak) in the north-west area of the Park lands, and two Saman sapplings on the east side of the Vlissengen Road, to fill gaps where trees had fallen.

23. The last 'Benab' at the top of the avenue became very dilapidated, and there being two others in this section, it was removed altogether.

24. The bridges over the side trenches in the lower part of the avenue were repaired and provided with handrails, and the lower bridge on the northern serpentine road was also repaired and new planks provided, the opportunity being taken at the same time to clean the channel beneath it.

25. Early in the year a Demonstration Apiary was set up in the northern section of the Park Land, near the iron bridge. A number of creepers and small flowering shrubs were planted along the surrounding fence, and specimens of bee plants were set out nearby. These included *Anacardium occidentale* (Cashew), *Citharexylum* sp. (Fiddlewood), *Eucalyptus* spp., *Haematoxylon campechianum* (Logwood) and *Pithecolobium brevifolium*.

26. The following 'bee plants' were distributed during the year, free of charge;—

Eucalyptus...	...	...	27 plants.
Logwood ...	...	...	54 "
Cashew ...	...	...	240 "
Genip ...	...	...	24 "
Fiddlewood ...	...	...	23 "
			368

27. The cart shed was rebuilt and rethatched during the year.

NURSERIES.

Ornamental Section.

28. The Rose collection has been attended to during the year, and several new additions made, including the variety 'Earl Haig.' The Rose beds were forked and limed, the bed in front of the nursery being entirely remade. A number of large concrete pots were obtained and proved a very satisfactory substitute for the wooden tubs in which the better varieties had been grown hitherto. Spaced out around the lawns west of the nursery, they make a fine showing.

29. A further covering of shell was spread on the floor of the Palm house the appearance of which is thereby considerably improved.

30. Ringing of Roses, Hibiscus and other plants was carried on whenever the weather was suitable—both to provide additional plants for the Gardens and to fulfil orders from the General Public.

31. A number of the larger palms and other decorative plants which had outgrown the tubs containing them were planted out in the Gardens.

32. The pink variety of Bougainvillea was extended along the west side of the vegetable garden, where it made rapid growth. In addition, several climbing and trailing plants were set out along fences in this part of the Gardens.

33. The orchid collection was well maintained during the year, one or two minor additions being made. One or more specimens of the following flowered during the year:—

Angraecium eburneum, *Aspasia epidendroides*, *A. principissa*, *Bletia paetula*, *B. purpurea*, *Brassia Lawrenceana*, *Catasetum scurra*, *C. viridiflorum*, *Cattleya Bouringiana*, *C. Deckerii*, *C. Jenmanii*, *C. labiata*, *C. Gaskelliana*, *C. labiata* vars. *Imperialis*, *Mossiae*, *Speciosissima*, *Superba*, *C. Luddemanniana Lowii*, *C. Skinneri*, *C. speciosissima*, *C. trianae*, *Cychnoches Dianae*, *Cymbidium pendulum*, *Dendrobium aggregatum majus*, *D. Gibsoni*, *D. moschatum*, *D. Phalaenopsis*, *D. superbum*, *D. transparens*, *Diacrium bicornutum*, *Epidendrum ciliare*, *E. difforme*, *E. fragrans*, *E. nocturnum*, *E. osmanthum*, *E. stenopetalum*, *E. variegatum*, *Gongora atropurpurea*, *G. maculata*, *G. nigrita*, *Herisia bidentata*, *Ionopsis teres*, *Lycaste Powellii*, *Mormodes atropurpureum*, *Oncidium altissimum*, *O. Lanceanum*, *Peristeria alta*, *P. elata*, *Phalaenopsis anabilis*, *P. Esmeralda Regnerii*, *Renanthera coccinea*, *Rodriguezia candida*, *R. secunda*, *Schomburgkia Lyonsii*, *S.sp.*, *Sobralia panamensis*, *Stanhopea eburnea*, *S. Wardii*, *Trichophilia maculata*, *Trigonidium Seemanii*.

Economic Section.

34. *Citrus*.—The propagation of budded orange and grapefruit of standard varieties continued to be one of the major operations in this section. In addition, budwood was obtained from some selected seedling orange trees in different localities in the Colony, which were known to bear fruit of a good quality. It was felt that fruit from the resulting budded trees would be readily acceptable for local markets, and for private gardens.

35. It was found that the bamboo underdrains laid down below the citrus beds to the east of the glass house effected a very considerable improvement in the roots of the plants raised there. A more branched root system, with a higher percentage of finer roots resulted, so that, apart from other advantages, many fewer casualties occurred in the process of lifting the young plants and establishing them in baskets.

36. The basketing of plants separately before distribution, although entailing some additional labour and expense, is found to be the most suitable practice for the requirements of the local farmer. In the rather heavy soil of the nursery, plants formerly had tended to put out one main taproot, with very few subsidiary roots, and the cutting of this long taproot, which was necessary for basketing, in many cases caused the subsequent death of the plant.

37. Treatment of developing sour orange and 'wild' grapefruit stocks with sulphate of ammonia shortly after bedding out was found advantageous, giving the stocks a good start. On the clay soils of the Gardens' Nurseries, the grapefruit seedlings make much more rapid growth than the sour orange, and are ready for budding about two months sooner. The bark of the grapefruit stock is also easier to manipulate when budding. On the other hand, the sour orange stock ultimately develops a rather more spreading root system than the grapefruit in the nursery beds.

38. A new area for citrus beds in the section east of the glass house was forked early in the year and put under Bengal Beans. At the end of the year these were turned in and the beds prepared for seedlings. In addition, a number of beds for citrus seedlings were prepared and planted during the year at the Experiment Station. Seedlings raised there, however, made rather poor growth.

39. The following tables serve to summarise the work on citrus propagation during the year :

	Seedlings Bedded out.	Seedlings Budded.		Budded Plants Basketed.	
		Orange. Budwood.	Grapefruit Budwood.	Orange.	Grapefruit.
Sour Orange Stock ...	3,393	668	1,141	505	640
Wild Grapefruit Stock ...	3,316	...	764	37	332
Total ...	7,709	668	1,905	542	1,022

40. A number of the plants shown above as having been basketed during the year were budded in the previous year, and similarly a number of plants budded in the latter part of the year were not ready to lift by the end of December.

41. A large number of seedlings were lost in the seed troughs by 'damping off' during wet weather.

42. The percentage of success in budding obtained was approximately as follows: orange on sour orange 45%, grapefruit on sour orange 41%, orange on 'wild' grapefruit 38% and grapefruit on 'wild' grapefruit 51% i.e., an average of about 44% of the stocks budded yielded plants for sale.

43. The amount of budded citrus distributed during the year was considerably less than in 1932. The reason for this was that, after the large output of the previous year, and owing to the limited space available, a period of almost a year elapsed before the stock of plants available could be brought up again in numbers. A large number of plants were basketed towards the end of the year, but were not ready for disposal until early in 1933.

44. The following table indicates the distribution of citrus during 1932 :—

	Grapefruit.	Oranges.	Total.
Berbice ...	229	210	439
Demerara—East Coast ...	38	49	87
„ —East Bank ...	100	60	160
„ —Georgetown ...	16	9	25
Pomeroon District ...	50	66	116
Total ...	433	394	827

45. New introductions of citrus plants included a Hybrid Lemon from Trinidad and a Hybrid Lime (*Woglum* x *W.I.*) from Dominica, plants of which were raised from seed. In addition, plants of a smooth-skinned variety of budded lime were received from St. Lucia. Also plants of 4 varieties of Tangelo ('New,' 'Sunrise,' 'Williams' and 'Sampson') were obtained from Trinidad. Representatives of all these have been sent to the North West Station, where a collection of all the recently introduced varieties of citrus has been made.

46. *Solar Propagator*.—A solar propagating frame, similar to one recently constructed at the Imperial College of Tropical Agriculture, Trinidad, was constructed at the beginning of the year, and a variety of cuttings of citrus and other plants tried out in it. The period required for effective root formation to take place was as follows :—

Seville orange cuttings ...	... 52 days.
Lime „ ...	... 22 „
Grapefruit „ ...	... 90 „
Dwarf Ixoras „ ...	... 45 „
Large Red Ixoras „ ...	... 50 „
Pink Bougainvillea cuttings...	... 50 „

47. The Lime cuttings rooted most easily, the other plants, though taking a longer time, included very few failures. An attempt to propagate Rose cuttings in this manner, however, failed entirely.

48. *Mangoes*.—The usual grafting of mangoes was carried out towards the end of the year, 108 approach grafts being made. The distribution of grafted mangoes during the year included 40 'Julie', 19 Ceylon No. I, and 24 of other varieties.

49. An attempt was made to establish a cover crop on the mango beds in the nursery. Two varieties of Bonavist Bean (*Dolichos Lablab*) proved fairly satisfactory, but efforts to establish *Dolichos Hosei* were unsuccessful.

50. Some experimental top working of mangoes was carried out during the year, including patch budding, shield budding, and wedge grafting of young shoots, the scion and the junction of scion and stock being protected by a covering of paraffin wax. The only method that has proved at all successful so far has been patch budding, but further work in this direction is to be carried out.

51. *Grafting*.—Wedge grafting and 'bottle' grafting of Avocado Pear shoots on to young seedling stock was attempted. The first efforts were not very successful, but with the experience gained, it is hoped to get better results in future.

52. Similarly, an initial attempt at wedge grafting Arabian coffee shoots on to Liberian coffee seedlings, covering the graft with a paper cap, as practised in Java, was only partially successful, the scion shoots supplied being rather too young. Greater success, however, should be attained at the next attempt.

53. *Oil Palms*.—A further consignment of Oil Palm seed was received from Java, and this time a good percentage of successful germination was obtained.

54. A number of Oil Palms from seed obtained in the previous year from Nigeria and locally, were sent to the North West Station, and others to the new Pineapple Co. on the Demerara River for trial.

55. *Pineapples*.—A quantity of pineapple suckers of the hardy variety 'Queen' were obtained from the Federated Malay States. A large number did not survive the journey, but some 200 plants were successfully raised, 150 of which were sent to Henrietta Experiment Station and 50 to the new Pineapple Company.

56. *Paths*.—The nursery paths between the benches had become very worn and were extremely muddy in wet weather. They were resurfaced with burnt earth.

57. *Apprentices Room*.—At the beginning of the year the Agricultural Apprentices vacated their quarters in Hadfield Street, these being taken over by Queen's College. The apprentices were boarded out, and in order to provide them with accommodation at the Gardens for taking their breakfast and attending lectures, a room was built for them east of the Glass House.

58. *Exhibition*.—At the B.G. Workers' League Exhibition held in the Promenade Gardens during October, an exhibit was set up to demonstrate some of the common methods of vegetative propagation, such as budding, grafting, etc.

59. The following tables indicate the general activities of the Gardens during the year :—

TABLE I.

Planted in Gardens	...	...Trees and shrubs 493.
Do. do.	...	...Border plants 20,420.
Plants basketed or potted	...	...Economic (other than citrus) 2,339.
Do. do.	...	...Ornamental 4,947.
Plants rebasketed or repotted	...	... 1,833.
Seeds sown (other than citrus and packets)	...	...14,589.
Plants ringed or layered	...	... 945.
Plants topdressed	...	... 2,584.

TABLE II.
PLANTS SOLD.

Economic Section.			Ornamental Section.		
Budded Grapefruit, Marsh	...	324	Palms	...	517
" " Duncan	...	89	Ferns	...	329
" " Var. A.	...	8	Begonias	...	64
" Orange, Navel	...	195	Crotons	...	28
" " Valencia	...	125	Ixoras	...	17
" " other vars.	...	68	Miscellaneous...	...	311
Grafted Mangoes	...	79			
Cocoa seedlings	...	165			
Nutmeg	...	35			
Miscellaneous—fruit trees, etc.	...	1,156			
Total		2,244	Bundles of Bamboo	...	220
				Total	1,266

TABLE III.
REVENUE RECEIVED DURING THE YEAR 1932.

	Sale of Plants.	Sale of Bamboo.	Sale of Lilies.	Hire of Plants.	Sale of Pots.	Miscellaneous sale of seeds, bulbs, cuttings, packages, etc.
January	\$ 34 12	\$ 2 00	\$ 1 52	\$ 96	\$ 4 32	\$ 1 12
February	24 67	3 35	1 26	...	2 40	86
March	27 61	1 77	38	...	5 38	46
April	35 91	1 27	2 72	1 04	...	60
May	14 50	1 65	7 58	2 48	36	96
June	19 18	3 00	5 49	1 88	20	08
July	69 12	1 85	1 79	56	2 60	24
August	13 64	2 00	4 73	1 80	...	01
September	36 51	1 34	4 28	1 36	26	...
October	52 01	2 80	5 36	3 96	2 40	74
November	28 28	1 30	60	72	...	88
December	38 30	4 80	2 82	2 24	40	72
Total	\$ 403 85	\$ 27 13	\$ 38 53	\$ 17 00	\$ 18 32	\$ 6 72

Total amount of revenue = \$ 511 55.

GOVERNMENT HOUSE AND PUBLIC BUILDINGS.

60. The vote for the maintenance of these Gardens was further reduced in 1932. At the Public Buildings and Law Courts the beds and lawns were maintained and periodically cut and weeded.

61. At Government House the shrubberies bounding the Gardens were cut back to allow of the repairing and repainting of the surrounding walks and fence by the Public Works Department.

62. A number of new plants were introduced from England, including some two dozen roses, the majority of which were successfully established in tubs. One or two innovations were also made in the contents of the vegetable garden with seed from England.

E. B. MARTYN,
Superintendent, Botanic Gardens.

January 25, 1933.

DEPARTMENT OF AGRICULTURE.

REPORT OF THE ENTOMOLOGICAL DIVISION FOR THE YEAR 1932.

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REPORT OF THE ENTOMOLOGICAL DIVISION FOR THE YEAR 1932.

STAFF.

F. A. Squire, B. Sc. (S.A.), F.E.S.	—Supernumerary Entomologist.
C. Williams.	—Entomological Assistant.
B. J. Ramotar.	—Laboratory Assistant.

GENERAL.

Mr. C. Williams was on leave from November 14, 1931 to March 14, 1932.

2. *Plant Protection Service Inspection and Fumigation.*—Several consignments of seeds imported into the Colony were fumigated by the Division.

One consignment of orchids exported to Venezuela was inspected and declared free from insect pests.

Canes imported from Porto Rico and grown on the Experiment Station were inspected.

3. *Collections.*—Considerable additions were made to the collection from time to time and several hitherto unrecorded species sent to the British Museum for identifications. The work of re-arranging the collection, hitherto arranged according to a numerical index, into families was begun. The collection in alcohol has been completed and the dry collection is well under way. Unfortunately, there is a shortage of insect drawers and cabinets which is proving a serious handicap to the building up of a first-class collection. The same congestion is apparent in the entomological library.

4. Life history work was carried out in the laboratory with insects collected from time to time especially on insects likely to become economically important.

5. An entomological exhibit was got up for the Workers' League Exhibition showing some of the principal insect pests of the various crops in the Colony, their life-history and methods of controlling them.

PRINCIPAL CROP PESTS.

Sugar Cane.

6. Hardbacks (*Dyscinetus geminatus* F. and *Dyscinetus bidentatus* Burm.)—Outbreaks of this pest occurred in January and in June. Contrary to expectations there was no outbreak in November. This was probably due to the fact that the rains did not commence until almost the middle of December, a month later than usual.

7. This pest finds an ideal breeding ground in the "forked" cane lands, where the clods lying closely upon one another provide a system of cool airy subterranean passages that can be easily penetrated by the adult in search of its food—decaying vegetable matter, and a suitable ovipositing ground. In the dry seasons the irrigated canefields provide possibly the main breeding grounds, in which the insect maintains itself.

8. Thus it will be realised that "Hardbacks" are not necessarily attracted to the fields by the sugar-canes but that the fields form a natural breeding ground in which the larvæ feed on rotting vegetation. When cane-tops are put in, however, they are quickly attacked by the pest. The relationship between the hardback and sugar-cane is interesting for the reason that it exhibits a transition from general to specialised feeding habits in the insect. Sugar-cane is becoming the preferred food of the hardback. In the case of the large hardback *Dyscinetus geminatus* F., this

change is taking place in larval stage; in the smaller *Dyscinetus bidentatus* Burm. in the adult stage. All local records of hardbacks on sugar-cane hitherto are records of the larval stage of *Dyscinetus geminatus* and of the adult stage of *Dyscinetus bidentatus*. These insects are found in situations other than canefields but it is in the canefields and feeding on cane-tops that they reach their greatest numbers.

9. It is a noteworthy fact that when outbreaks occur in the mid-year wet season the species concerned is usually *Dyscinetus bidentatus*; whilst attacks in the end-year wet season are usually caused by *Dyscinetus geminatus*.

10. Flooding, which under local conditions is easily accomplished, is the best control measure. In the case of *Dyscinetus bidentatus* the control is not quite so simple. The larvæ which can be destroyed by flooding are not injurious, feeding as they do on decaying vegetation, and are therefore easily overlooked. It is the adult that is injurious and in this stage the insect cannot be controlled by flooding. It behoves farmers therefore to look out for the presence of large numbers of this insect in the larval stage and to flood before the life cycle is completed.

11. The Fungus *Metarrhizium anisopliae* attacks larva, pupa and adult but the dry conditions favouring the fungus are themselves antagonistic to the beetles so that the fungus probably has no limiting influence on the numbers.

12. The larvae of both hardbacks are parasitised by two wasps of the family Scoliidæ, and by the Asilid *Mallophora callidus* F. These parasites are not numerous and have little if any effect in keeping down numbers. They probably kill only an infinitesimal fraction of those that would in any case succumb to adverse natural conditions, such as droughts and floods.

13. *The Yellow Sugar Cane Aphis*, *Sipha flava* Forbes.—This pest became sufficiently widespread to attract notice during the year. Its natural enemies, the coccinellids *Megilla maculata* deG. and *Neda sanguinea* L. and the syrphid *Ocyptamus dimidiatus* F. were not slow in reducing its numbers. The Kiskadee, *Pitangus (Tyrannus) sulphuratus*, a protected bird, preys on these predators but not on the aphis itself, thereby affording the aphis a certain amount of protection.

Rice.

14. *The Rice Weevil (Calandra oryzae L.)*.—This pest continues to cause serious loss to traders in rice. Under local conditions, fumigation on a large scale is not possible. Other methods of control are therefore being investigated.

15. Experiments were conducted to determine the effect of *Sodium fluor silicate* on the rice weevil when mixed with rice. Results so far do not justify any conclusions being drawn.

16. It is a matter of common observation that the weevil is scarce during the dry seasons and more plentiful during the wet seasons. An experiment was laid down to determine the effect of the dry and the wet seasons on the life of the weevil. Six bags of rice were kept under observation.

17. The method of sampling was to take samples from six regularly spaced points on each side of the bag and to make a composite sample. Samples were taken at the end of September and at the beginning of November. The following figures were obtained:—

	Weevils dead.	Weevils alive.	Total.
September ...	1,314	327	1,671
November ...	1,913	227	2,092

Rate of increase 25.2 per cent. during October. Death rate 39.3 per cent. during October. Death rate higher than rate of increase by 14.1 per cent. Figures for the wet season have not yet been obtained.

18. Experiments have been conducted to correlate weevil infestation with the hardness of rice and with relative humidity.

19. A machine was constructed for measuring the hardness of rice in terms of pounds pressure required to crack the grains. The machine consists of a wooden beam 36 inches long, one inch by one inch in cross sections, graduated in inches. The beam is attached at the $\frac{1}{2}$ inch mark to a table. On the under surface of the beam at the 4 inch mark there is a steel boss which rests upon a steel plate attached to the table. A scale pan is attached to a rolling-pin which rests on the beam. By turning the rolling-pin, the distance of the scale pan from the fulcrum can be varied. By taking the reading when the grain cracks, the pressure on the grain can be calculated.

20. (a) The following varieties were tested for hardness :—Demerara Creole, No. 79, H.7, A.16.34, Kalyaman, Ramcajara, Blue Stick, Lead Rice, Hope, Kristna Kata Kulu. Figures obtained so far tend to shew that there are no marked varietal differences. The investigation is proceeding. In every case reading was taken for 100 grains and the true mean calculated. From the figure so obtained the hardness of the grain is calculated.

(b) There is marked difference between parboiled and white rice; white rice being much the softer as the following figures shew :—

PARBOILED RICE.		VARIETY 79.	WHITE RICE.
(41 days after parboiling and milling)			(41 days after milling).
Hardness ...	... 11.14 lbs.		4.28 lbs.

(c) Parboiled rice increases in hardness with lapse of time after parboiling. Thus :—

DEMERARA CREOLE.	
(50 days after parboiling and milling).	(90 days after parboiling and milling).
Hardness ...	... 10.6 lbs.
	14.22 lbs.

Rice is hardened rapidly by heating but soon returns to its normal hardness. Thus :—

Variety A.16.34 heated for 45 minutes at 36-39° C.

Hardness before heating	...	...	10.7 lbs.
„ after heating	...	...	19.7 „
„ 20 hours after heating	...	...	14.0 „
„ 4 days after heating	...	...	10.7 „

(d) Samples of Demerara Creole rice were placed in atmosphere of relative humidity 90 per cent., 82 per cent., 77 per cent., 50 per cent. for 5 days. The following figures show how the relative humidity affected the hardness during that time :—

Relative Humidity.		Hardness.
90 per cent.	...	6.0 lbs.
82 per cent.	...	6.0 „
77 „ „	...	11.68 „
50 „ „	...	24.58 „

(e) Weevils were placed with rice grains in the same range of atmospheres. The experiment is still in progress but results hitherto shew that the life cycle is shortest in the atmosphere of relative humidity 90 cent. and that very few eggs were laid in the grains at 50 per cent. relative humidity. These eggs did not develop.

21. Experiments were carried out to determine the effect of relative humidity on the life of the adult weevil. The figures obtained show that the weevil thrives

best in an atmosphere of relative humidity 90-1 per cent. and that the prevalent relative humidity of the dry season is low enough to have a detrimental effect on the adult weevil.

22. The following figures represent the percentage mortality of weevils on exposure to atmospheres of different relative humidity for 90 hours.

Relative Humidity.	Percentage Mortality.
90 per cent.	0
80 " "	5.5
70 " "	10
60 " "	16
50 " "	25
40 " "	42
30 " "	89
20 " "	100
10 " "	100

23. The practice of rehulling weevilly rice with the object of pulverising and so eliminating the infested grains thus rendering it fit for exportation, is quite a common practice in British Guiana. Experiments were conducted to determine the precise effect of rehulling on the weevil. The figures obtained show that of the survivors—73.5 per cent. were in the egg stage at the time of rehulling; 21.3 per cent. were in the first half of the larval stage and 4.5 per cent. were in the second half of the larval stage. None survived the pupal stage. Emergences commenced on the fifth day after rehulling showing that the insect survived even in the pre-pupal stage. At the commencement of the investigation the percentage infestation was about 1.5. The percentage infestation after rehulling was 0.6. 1.0 per cent. is the maximum infestation allowed in exported rice.

24. *The White Stem-Borer of Rice, Scirpophaga albinella Cram.*—There was a severe outbreak of this insect during the earlier part of the year.

25. Experiments have been carried out with light traps. Figures shew that light traps destroy many of the moths including young as well as gravid females. A light trap exposed for twenty-one nights from May 30, 1932 to June 6, 1932 and June 23, 1932 to July 7, 1932 gave the following total catch :

Males	...	...	407
Young females	...	...	30
Gravid females	...	...	136
			} 166

The eggs of this insect are parasitised by a minute Hymenopterous insect which has not yet been determined.

26. During an attack an attempt was made to estimate the incidence of parasitism. 1,880 egg-masses were collected practically all showing signs of parasitism—within three or four days after the appearance of the moths. These egg-masses yielded 4,608 parasites. Unfortunately many of the parasites succumbed inside the egg-masses to laboratory conditions. It was not possible accurately to estimate the number that so died so that one can only say—each egg-mass consisting roughly of 100 eggs—that the degree of parasitism calculated from parasites actually emerged was 2.4 per cent. of the individual eggs. Taking into account the parasites that succumb, the incidence of parasitism is probably nearer 14 per cent. of the eggs. It must be remembered moreover that these eggs were collected within 4 days of the commencement of the attack. As the parasite has a life-cycle of 13 days according to laboratory observations, one must expect the incidence to rise considerably at a later stage of the attack.

The larva is parasitised by the braconid *Hecabolus* sp. Thirty of these were seen to emerge from one pupa.

27. This pest exhibits a marked periodicity, occurring in vast numbers generally at the commencement of the rainy seasons in about May and December. At such times the conspicuous egg-masses are scattered over fields of young rice attached to the blades in such numbers as to give cause for anxiety. Fortunately the attack usually fizzles out, and but little damage is done. The emerging moths are not numerous and the species invariably disappears until the next periodic outbreak. The fact that the pest is not a serious one when it occurs in large numbers is probably due to the influence of its parasites.

28. *The Stem-Borer of Rice, Diatraea saccharalis* F. This stem-borer of rice has not been serious during the year.

Coconuts.

29. *The Coconut Caterpillar, Brassolis sophorae* L.—A station was started at Plantation Hope, East Coast, Demerara, for the purpose of conserving the parasites of this pest and breeding the parasites on unparasitised material brought in during attacks. It was hoped to develop a technique for this work and to get the station into working order before the next attack. Unfortunately the station had to be abandoned owing to lack of funds. There was no serious outbreak of the pest during the year.

30. The parasites of *Brassolis sophorae* L. are:—

<i>Spilochalcis brassiolis</i> Schr.	} Pupal parasites.
<i>Chalcis annulata</i> F.	
<i>Phaeocera tincta</i> Walk.	issuing from pupa.
<i>Telenomus nigrocoralis</i> Ashm.	} Egg parasites.
<i>Anastatus reduvii</i> How.	

31. *Cockles, Strategus aloecus* Fabr.—These beetles attack young coconut trees entering the soil at the base of the tree and boring into the stem from below. If left undisturbed, they eventually kill the tree. The presence of this pest can be readily detected by its burrow at the base of the tree. A piece of calcium carbide inserted into the hole drives out the beetle, which can then be destroyed.

Pineapples.

32. The pineapple bug *Athamastus latus* Mayr. continues to occur in the pineapple cultivations on the West Bank, Demerara River, and other parts of the coastlands, but has not yet made its appearance at the pineapple cultivation at Amsterdam, Demerara River. The insect is indigenous, and its natural food plant is the wild pine. It is therefore surprising that it has not yet reached the Amsterdam cultivation which was started in 1931. Wherever the younger fruit has been punctured gumming ensues and if the fruit is young malformation follows.

33. A Scelionid egg-parasite *Hadronotus rugosithorax* Ashm. determined by Dr. Ferriere has been bred from the eggs in the laboratory. There is one parasite in each parasitised egg. The life-cycle is 12 days in length.

34. The cause of black-spot in pineapples at the pineapple plantation Amsterdam, Demerara River, was investigated. Secondary insects were found in the diseased fruit but the disease was not caused by an insect.

35. The red ant *Solenopsis* sp. attendant on the mealy-bug *Pseudococcus* sp. is at times a pest in the pineapple fields where it constructs its "sheds" round the plant which may possibly be retarded when these sheds are extensive. The mealy-bugs are usually found between the leaves near the base of the plant. They are not very numerous—having been found on only a few plants. So far no injurious effects have resulted from the attack of this insect.

MISCELLANEOUS PESTS.

36. Coushi ants, *Atta petaspina* Reich, *Atta cephalotes*, L., *Atta ferreus* Say, and *Atta laevigata* Smith all occur locally. In the heavier soils of the coastal belt this

pest is comparatively easily controlled with carbon bisulphide which is poured down the main shafts of the colony and confined to the nests by closing up all the entrances. A common local practice is to explode the gas in the soil. I cannot however recommend this. In the sandy soils of the interior however, where this insect is exceedingly numerous, there appears to be no effective measure, as the soil is too porous to hold gases. In an experiment carried out at Sandhills, Demerara River, cyanogas and acetylene gas were used as well as carbon bisulphide with no avail. Moreover the nests are not isolated or confined to circumscribed areas as in the coastal belts, but are spread out over the countryside—entire hills being undermined by the ants.

37. The principal garden pests have been the soft scale *Orthezia* sp. which usually clears up following pruning, opening up and attending to drainage.

38. The Limacodid, *Camila fusca* Stoll. has appeared in broods throughout the year doing a good deal of damage to citrus and ornamental palms.

POISON PLANTS.

39. *Haiari*.—Following a report from the Agricultural Superintendent of the North West District, British Guiana, in which he claims to have obtained excellent results with an aqueous extract of Haiari as a spray against a species of ant (probably *Prenolepsis* sp.) infesting the coffee trees there, a series of tests was carried out in Georgetown with a view of investigating the claims mentioned.

40. Young shoots were obtained from the North West District and aqueous extracts made of the bark, stems and leaves, while these were still fresh. In each case the material was ground up and allowed to soak overnight in closed vessels. Similar extracts were made using hot water instead of cold water.

41. Later carbon tetrachloride was used instead of water. The carbon tetrachloride was allowed to evaporate off and hot water added to the residue.

42. Some leaves were killed by dipping in boiling water. Carbon tetrachloride was then added and allowed to evaporate when hot water was added to the residue.

43. These sprays were tried out on the red stinging ant, *Solenopsis* sp.—the ant which was the subject of the experiment in the North West not being available. None of the extracts had any effect on the ants. The investigation is proceeding.

PUBLICATIONS.

44. During the year the following publications were made :—

“Insect Pests,” published in a special bulletin under the title of “Proceedings of the Second Annual Meeting of the Buxton-Friendship Farmers’ Union,” August, 1932.

“Oviposition of *Telenomus nigrocoxalis* Ashm. in Nature” April 9, 1932.

ACKNOWLEDGMENT.

45. A word of acknowledgment is due to Messrs. C. Williams and B. J. Ramotar for the spirit of co-operation and unselfish endeavour which they have displayed in every undertaking of the Division.

F. A. SQUIRE,
Entomologist.

January 14, 1933.

DEPARTMENT OF AGRICULTURE.

REPORT OF THE LIVESTOCK DIVISION FOR THE YEAR 1932.

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REPORT OF THE LIVESTOCK DIVISION FOR THE YEAR 1932.

STAFF.

Major T. Bone, O.B.E., M.R.C.V.S.—Government Veterinary Surgeon.
W. Khan —Foreman.

GENERAL.

The Government Veterinary Surgeon was absent on leave from January 21 to September 4. On October 1 he proceeded to the Rupununi District to investigate an outbreak of disease amongst cattle and to inspect the Cattle Trail. He returned to Headquarters on September 16. During his absence Mr. A. Fulton, B.Sc., M.R.C.V.S., D.V.H., acted as Government Veterinary Surgeon; the Superintendent of Agriculture, East Demerara, supervised the Stock Farm, and Mr. John Fernandes supervised the poultry section.

ANIMAL HUSBANDRY.

2. *Cattle*.—It was not possible to establish stud-bull centres under Government control in the district during the year. Owing to the need of improving stock it was thought advisable to make another trial with stud-bulls on plantations. Unfortunately, the trial was not a success. Good working bulls were sent to the districts but were returned with bad reports. It was stated that they would not serve, or if they did serve there were no results. On return to the stock-farm, the bulls were difficult to handle, and had to be carefully managed for some weeks before they became quiet. They then worked normally.

The districts are in urgent need of improved bulls, and the only solution is the establishment of stud-bull centres under Government control. Improvement in the methods of handling animals and the conditions under which they live are required in the districts. Stock-owners in the Georgetown area visit the stock-farm and many, as far as is possible, adopt the intensive system of stock management which is practised on the farm. The results obtained are good. Stock-owners in outside districts are unable to visit the stock farm, and consequently do not see the better results of more careful management. Farmers in the districts are handicapped by the low price paid for milk on the farm. The profits are so very small that they view all suggestions as to improvement of stock and improvement of conditions with apathy.

Farmers in the vicinity of Georgetown are able to sell their milk direct to private customers or to dairies at reasonable prices. Co-operation by district farmers in the sale of milk would enable them to get better prices without increasing the price to the consumer.

3. It is generally known that the extensive coast savannahs which are flooded during the rains and which are frequently hard, barren, waterless areas in dry weather are not suitable for stock-raising. Very many calves are lost during periods of flood and drought. There are few areas on the coast where cattle can be profitably managed on an extensive system, and even in these favoured areas, better results would be obtained if it were possible to drain and irrigate the land. On the other hand, almost every part of the coast districts is suitable for the intensive system of stock management. Various fodder plants and grasses can be easily grown.

A Government stock centre, although limited to a stud-bull, pigs and poultry would serve as a demonstration of what can be done under intensive management.

4. The position as regards beef cattle has not yet improved, but there are signs that a greater interest in this industry is being taken.

The Rupununi Development Company has despatched four imported Hereford bulls to their ranch in the Rupununi. These bulls were immunised against piroplasmosis and anaplasmosis at the laboratory of the Ministry of Agriculture and Fisheries, Weybridge, England. If carefully managed, these bulls will be a great asset to the Company.

A number of Brazilian oxen have been imported and after being grazed for some months in the Rupununi district, have travelled the trail and arrived on the intermediate savannahs in good condition.

A new model abattoir has been built by the Georgetown Municipality, and a private company has built a meat factory.

5. *Pigs*.—The pig industry is slowly improving. The establishment of a local meat factory will probably give an impetus to this industry.

6. *Poultry*.—The Poultry Association staged a second annual show at the exhibition given by the British Guiana Workers' League. The number of entries was greater than last year and the show proved a success.

A considerable number of standard bred birds has been imported, and also many day-old chicks by seaplane from U.S.A. The chicks were purchased from a hatchery, and it has yet to be proved that they are worthy of importation. The Association realises that the importation of birds and chicks is of no assistance to poultry-keepers unless those imported are of superior quality to local stock. The price of eggs is very low and the cost of imported poultry food is very high. No poultry-keeper can hope to make a profit if he feeds imported foodstuffs.

ANIMAL HEALTH.

7. *Rabies*.—A commission of Brazilian veterinarians operating in the Rio Branco district of Brazil was granted permission to investigate an outbreak of disease amongst cattle in the Rupununi district. Two days were spent in making post-mortem examinations and specimens were collected. An official report of this investigation has not yet been received.

8. The material collected was examined at the well-equipped laboratory in Boa Vista. Unofficially, one veterinarian reported that Negri bodies were found in specimens of brain collected from cattle in the Rupununi. The disease is said to be transmitted by blood-sucking bats.

9. The affected area was visited by the Government Veterinary Surgeon and several days were spent observing sick cattle and making post-mortem examinations. Specimens of brain tissues were collected and sent to Trinidad for examination in a laboratory. A report of this examination has not yet been received.

10. The symptoms exhibited by the sick cattle were so different from those shown by rabid cattle in other countries that they are recorded as follows ;—

“The sick animal leaves the herd. At this time, before any other sign of disease is shown, the temperature was found to be 103.4° F. The animal grazes slowly and intermittently. It is very depressed. It is not aggressive and takes little notice of horses or men on foot. Unlike a normal range animal, it is easily captured. When lassoed it stands still—it is too sick to move. Later, saliva dribbles from the mouth ; at first this is not continuous. The animal rubs its neck and withers against trees or ant-heaps. Inco-ordination of movement follows with slight tremor of the flank muscles. The inco-ordination of movement is not continuous ; after a brief time the animal regains control and can be driven gently. When driven in this manner, the animal will travel one-quarter to half a mile and will then sink to the ground as if completely exhausted only to recover completely in one or two minutes. Switching of the tail is more or less continuous.

"When taken into a water hole the animal attempts to drink but is unable to swallow.

"When left to itself the animal stands for long periods and if near a tree or ant-heap will rub its neck and withers at intervals. It faces the wind with extended neck. For very brief moments it lies down.

"The disease progresses rapidly; dribbling of saliva becomes continuous. The animal is unable to drink and makes no attempt to graze. Movement becomes more difficult. The sight is affected; only moving objects are seen. The temperature becomes sub-normal. The animal lies down and dies quietly in from 36 to 72 hours after the onset of symptoms."

11. So far as could be ascertained the cattle which died were of either sex between 3 or 4 years of age or older. No sick calf was seen and no carcass of a calf was found.

12. A peculiar feature of the outbreak was that most of the carcasses found were on the land usually occupied by the herds when resting at night; the wanderings of a rabid animal are usually aimless.

13. *Post-Mortem Examination*.—A serious exudate was found under the skin of the neck and withers caused by the animals rubbing against trees or ant-heaps. The lesions constantly found were severe catarrhal inflammation of the epiglottis, larynx and trachea.

14. *Stiff-Sickness*.—Phosphorus deficiency in the Rupununi District has been reported.

A mob of 500 oxen collected for export to the coast was inspected. A considerable number of animals showed the typical symptoms of stiff-sickness.

Although chewing of bones by cattle is common throughout the whole of the District, about 7,000 square miles, evidence of "stiff-sickness" has been noted on one ranch only. The cattle on this ranch are inbred, no fresh blood has been introduced for many years.

15. *Anaplasmosis*.—Two Guernsey bulls were immunised against this disease at the laboratory of the Ministry of Agriculture and Fisheries, Weybridge, England, before importation. Two Guernsey heifers imported two months prior to the bulls and which were not immunised have been subject to infection. They were young animals, 6 to 8 months old. One heifer showed signs of sickness and was treated at once with Sodium Cacodylate and recovered quickly.

RUPUNUNI SAVANNAHS.

16. A report was made on these savannahs and published in 1930. A second tour corroborates the first impressions. ^{There is} ~~There are~~ excellent cattle and sheep country of an area of approximately 7,000 square miles.

CATTLE TRAIL.

17. This is the key to the Rupununi District. The trail passes through forest for 140 miles and then passes over 40 miles of savannah to the export stelling on the Berbice river. The provision of water and rest camps at reasonable distances is now assured. The provision of fodder *en route* is only a matter of time. Under present conditions cattle of good type and in good condition have travelled the trail with very minor losses. After a few months on the intermediate savannahs, which savannahs were formerly regarded as useless for cattle, they have recovered or maintained the condition in which they left the Rupununi and are fit for export.

On the other hand, cattle of poor type which have been left to go wild on the Rupununi savannahs, suffer heavy losses on the trail, and those which reach the coast savannahs never regain the condition they had when in the Rupununi.

INTERMEDIATE SAVANNAHS.

18. These savannahs cover a very extensive area. The experience of the past over comparatively small areas, chosen more for their convenience of export to the coast than for any other reason, which have not proved successful should not be allowed to cloud the possibilities of the whole area. A field experiment to be undertaken next year with Rupununi cattle will be a valuable test of another part of these savannahs.

19. The great importance of these intermediate savannahs lies in their relation to the Rupununi Savannahs. At the present time, Rupununi cattle are brought from comparatively dry country to the coast. Anyone who has watched the coast creole cattle walk through the ordinary flooded savannah of the coast will realise that such an animal knows its land. Its efforts to move are not excited but calculated. A Rupununi animal under the same conditions flounders and becomes exhausted and not infrequently bogged. In these circumstances, the losses are heavy, and few cattle regain their old condition.

20. Grazing areas on the intermediate savannahs are more suitable for Rupununi cattle.

FODDER PLANTS AND GRASSES.

21. The importance of the study and trial of fodder plants and grasses can be realised if the coast areas of savannah are compared with the comparatively small areas suitable for agriculture. Much progress has been made in the distribution of Guatemala grass and Demerara Primrose by the Experiment Station. This grass and plant together with Para grass make excellent forage for those farmers who have adopted an intensive system of cattle management on the Coast.

22. *Alysicarpus vaginalis*, locally known as 'horse-weed,' is a leguminosae which grows on the pasture of the stock-farm. A small bed was prepared in order to collect seed towards the end of 1931; the experiment was transferred later to the Experiment Station where it has proved most successful. Seed has been collected and some issued for trial on the intermediate savannahs.

23. Wynne grass supplied by the Experiment Station was planted over a small area of prepared land on the stock-farm. The stockman reports that the cattle ate this grass greedily, but that during the heavy rains the land became swampy and he was obliged to remove the cattle. After an interval of three weeks, the pasture was again fit to graze, but heavy rains fell again and the area was abandoned. Water grass and sedges smothered the Wynne grass. A further test is being made.

24. The difficulty of transport has prevented experiment on a large scale being made in the Rupununi and on the cattle trail. The Superintendent of Agriculture is experimenting with seed and the difficulty will be overcome.

25. On the savannahs and trail pasture grasses are required and the use of forage plants which have to be cut and fed can be only considered as emergency measures on the trail until such time as pasture grasses can be established.

26. Sudan grass was imported some years ago but was not a success because of a disease. In spite of the disease and the non-cultivation of the grass it has been found growing in isolated areas. A small bed now growing on the Experiment Station appears to be free from disease.

27. *Johnson Grass*.—A dreaded weed in cultivated areas and one which it is difficult to eradicate, may prove to be a suitable grass for the trail and savannahs.

FOODSTUFFS.

28. The locally made coconut meal is a very satisfactory foodstuff. The amount of corn grown in the Colony does not meet the demand, and frequently the price at which it is offered for sale is beyond the stock-keeper's ability to pay

This is a stock-feed which could be grown in larger quantities and be sold at a reasonable price. At the prices at which milk, eggs and poultry are sold the absence of foodstuffs which can be purchased at a reasonable price is a great handicap.

29. Imported foodstuffs are expensive. It may not be possible to manufacture balanced rations composed entirely of local products, but it is possible to compose balanced rations of which the greater part is local produce.

30. The stock-farm makes up its own rations which give satisfactory results. Other stock-owners would like to use similar rations but cannot do so for lack of a mill for grinding, etc.

STOCK-FARM.

31. *Cattle*.—There are now six Holstein Fresian bulls, two Guernsey bulls, and four cows and six heifers of Holstein-Fresian breed.

32. *Pigs*.—The only breed kept on the farm is the Canadian Berkshire which does well under local conditions. ^{These} ~~These~~ boars have been lent to districts for stud purposes. The sale of young pigs continues, but it is not proposed to increase the number of breeding stock until the market improves. Forty young pigs were sold.

33. *Donkey*.—There is little demand for the services of the stud jack.

34. *Poultry*.—The exceptionally heavy rainfall during the breeding season caused these operations to be suspended.

35. The old pens have had to be culled so that instead of an increase of stock birds there is a decrease. Two trios of birds imported from England proved not to be up to specification. The vendor was informed, and two other trios are to be sent out next year. Unfortunately, this leads to delay in breeding operations.

36. Incubators and battery brooders have been imported.

37. During the year 766 selected eggs were sold for hatching purposes, and 4,210 eggs were sold for table purposes. 30 chickens were sold.

MISCELLANEOUS.

38. As in previous years the Agricultural Superintendent, East Demerara, has supplied foodstuffs, unsuitable for sale or distribution to farmers for the use of the live-stock. He has taken a very active interest in the cultivation of fodder plants and grasses as shown in his report.

39. *Revenue*.—Sale of stock, eggs, stud and inspection fees yielded a revenue of \$574.29. The decrease of revenue is accounted for by the few inspection fees.

40. *Importation*.—Breeding stock;—

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Goats	...	...	2
Sheep	...	...	2

T. BONE,
Government Veterinary Surgeon.

March 3, 1933.

